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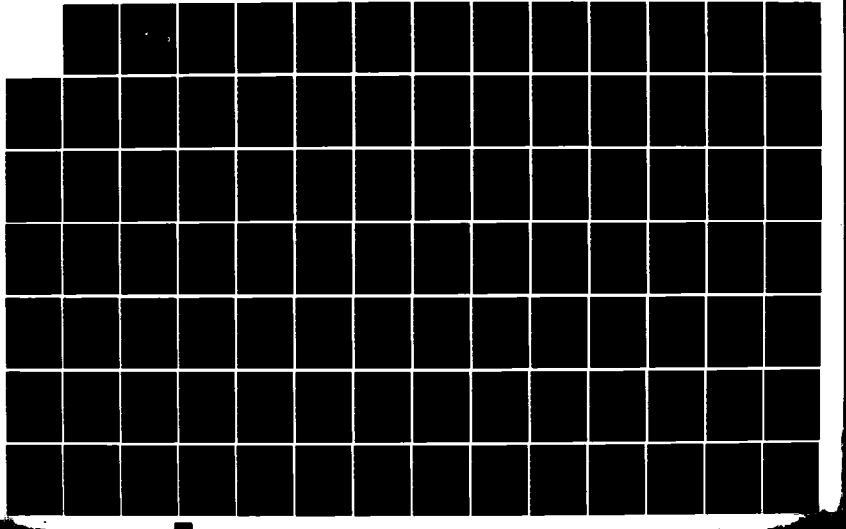

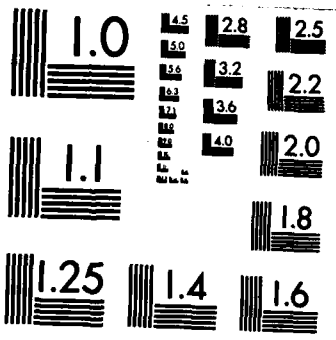

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN AUTOMATED QUALITY ASSURANCE SURVEILLANCE PLAN
FOR ADP OPERATIONS UNDER THE NAVY'S
COMMERCIAL ACTIVITIES PROGRAM

by

Howard E. Morton
December 1984

Thesis Advisor: Dan Boger

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ABSTRACT (Continued)

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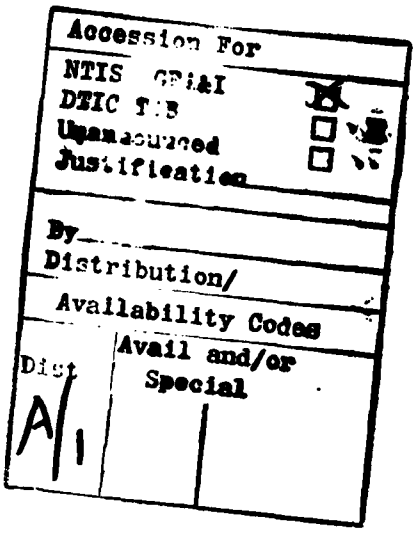

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An Automated Quality Assurance Surveillance Plan
for ADP Operations Under the Navy's
Commercial Activities Program

by

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Lieutenant, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

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This thesis documents the process whereby a Navy Regional Data Automation Center implements an automated quality assurance program to ensure proper performance of a commercial service contract by a civilian contractor. The feasibility of implementing MIL-STD-105D on microcomputers is examined, along with the software tools necessary for that implementation. Finally, a system design and programs to effect such an implementation are proposed.

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I. INTRODUCTION

In any environment where one organization contracts with another there arises concern over whether the contractor is performing up to the standards expected by the organization which employs him. This is especially true in today's Navy, with its commitment to exploring the possibilities of civilian contractors taking over functions which have heretofore been run by Naval personnel and civil service employees. This commitment to exploring commercial service contracts was occasioned by senior policy makers' determination to obtain quality services at minimum prices.

This senior policy guidance has had significant impact upon the Naval support establishment and has resulted in numerous studies to determine the most efficient means of obtaining a host of services currently performed by the Navy itself.

Of particular interest is the possibility that the operations of some or all of the Navy's regional data automation centers (NARDACS) may come under commercial service contract operation. Because of the tremendous amount of data processed by these centers, they are extremely important to the smooth operation of the fleet. The adverse consequences of poorly run ADP services can

scarcely be overestimated. It is of critical importance that there exists a sure, secure method of assuring the quality of ADP services operated under service contract. This, then, is a description of the methodology used by one command to automate an existing quality assurance standard in order to ensure its proper operation.

II. BACKGROUND

A. PROJECT ORIGIN

The Naval Regional Data Automation Center (NARDAC), San Francisco CA, established in 1978 as a tenant command at Naval Air Station Alameda, is an echelon three shore activity under the Commander, Naval Data Automation Command (COMNAVDAC). NARDAC's mission is to provide automated data processing (ADP) services to Naval activities in the San Francisco area and wherever else directed by COMNAVDAC. Commands supported by NARDAC include Naval Air Rework Facility, Alameda; Naval Air Station, Alameda; Naval Air Station, Moffett Field; Naval Air Station, Lemoore; Naval Support Activity, Treasure Island; Naval Supply Center, Oakland; the Commander in Chief, United States Pacific Fleet; and the Fleet Accounting and Disbursing Center, San Diego. In order to support this mission, NARDAC also manages and directs remote facilities in order to provide local data processing support in coordination with the regional center; it designs, develops and maintains automated data systems; and it performs such other tasks as may be directed by COMNAVDAC.

NARDAC is in operation twenty-four hours daily, every day of the year. In the course of the average day's

operation, there are approximately ten thousand individual jobs completed. These jobs often include the production of physical output product: printed pages, Hollerith cards, microfiche, etc. This output is provided to end users in a variety of ways: transmitted electronically; physically shipped to the user, left available for pickup at the center, or one of several remote sites; or mailed.

NARDAC San Francisco is staffed by a mixture of Naval personnel and civil service employees under the command of a Navy captain. There are subordinate remote activities at NAS Moffett Field and NAS Lemoore, each with its own staff under the direction of an officer in charge, who reports to the Commanding Officer, NARDAC San Francisco. The total staffing, including personnel at the remote activities, is approximately 50 military and 280 civil service employees.

In September 1982, the Chief of Naval Operations notified the Naval Regional Data Automation Center, San Francisco that Data Automation Services and System Design, Development, and Programming services currently being conducted in-house by NARDAC San Francisco would be included in cost studies conducted in accordance with OMB Circular No. A-76 [Ref. 1]. The Commander, Naval Data

STD-105D, as the service contracts mandated by OMB Circular No. A-76 prescribe payment to the contractor in terms of a day's efforts. This has led to the definition by the project team of a lot as being the output for one day's work by the contractor, measured from 0000 to 2359 local time. While this definition circumvents the previously mentioned difficulties, it also causes a few new problems; looking at the MIL-STD-105D tables shown in Appendix A, Table 1, the Sample Size Code Table shows code letters L and M for General Inspection Level II and lot sizes of 10,000 and 10,001 respectively. Checking Table II-A, the Master Table for Normal Inspection, Single Sampling, we see that this table prescribes sample sizes of 200 and 315 samples respectively. While this large variability in sample size may result in a high degree of variability in the workload of the QA personnel conducting the inspections for attributes, the only other alternative is worse. That alternative would consist of conducting inspections of fixed size, but variable times. The deduct analysis wherein the contractor is penalized for poor performance would, in this case be exceedingly difficult to implement.

The daily variability in sample size complicates the problem of obtaining the correct information from the tables. This is occasioned due to the fact that QA

III. IMPLEMENTATION OF MIL-STD-105D AT NARDAC SAN FRANCISCO

Material in this chapter is taken from a series of discussions with Mr. Al Hinds, Naval Regional Data Automation Command (NARDAC) San Francisco, CA which took place from September 1983 through May 1984. Mr. Hinds is conducting the Commercial Activities (CA) study for Data Processing Services at NARDAC San Francisco.

A. DETAILS REQUIRING CLARIFICATION

Several particulars need be resolved before MIL-STD-105D can be implemented as the method of choice for quality assurance at a regional data center; many of these concern the center's massive daily output.

What constitutes a lot? In traditional manufacturing where MIL-STD-105D was first implemented, the definition of a lot as a given number of pieces of physical property could be easily effected. In the world of ADP, any predefined number may lead to difficulties. These difficulties arise from the fact that the output of a computer center for just one day is apt to be both massive and variable. During a very slow period, ten thousand units may represent several day's output, while during times of peak load, it may not reflect all of one day's jobs. This notion of days is central to the implementation of MIL-

discrimination his sampling must effect and whether each sample will be inspected once, twice, or more. Normally, the lot size must also be decided upon as well.

lar No. A-76 is meeting his contractual obligations regarding timeliness and quality of product, Supplement I to OMB Circular No. A-76 mandates that a quality assurance and surveillance program be developed and operated by CA personnel. This program is to be designed and conducted in accordance with OFPP 4.

7. While several methods for the conduct of quality assurance programs are delineated in OFPP 4, the statistical method is most widely used as it does not require examination of all the contractor's product. The statistical methods specified in OFPP 4 are contained in MIL-STD-105D, which is widely used and understood by both government agencies and contractors.

8. MIL-STD-105D is based on the random sampling of events for specified attributes. Before the standard can be utilized, the user must determine what proportion of defective performance he can tolerate and then specify that as an AQL. The AQL becomes, in effect, the contractor's 'target'; he must perform to at least that standard of excellence in order to receive full remuneration for his efforts. Furthermore, the contract administrator must decide how much

E. BACKGROUND SUMMARY

At this point, the status of this study is summarized as follows:

1. NARDAC San Francisco is a central ADP facility providing a variety of computing services to customers at several geographic locations.

2. NARDAC is in continuous operation, completing an average of ten thousand jobs daily.

3. NARDAC is staffed by military and civil service employees.

4. Higher authority has mandated that a cost comparison study be conducted in accordance with OMB Circular No. A-76 in order to determine if NARDAC's operations will remain in-house or will be contracted out to a civilian contractor using government furnished equipment and supplies.

5. Continued operation of commercial activities by the government is allowed by OMB Circular No. A-76 if the government can operate those activities at a lower cost than qualified civilian contractors.

6. In order to ensure that any contractor performing commercial services under the auspices of OMB Circu-

needed. Among the three general levels, Level I is used where reduced discrimination is acceptable; Level II is the normal inspection level; finally, Level III is utilized where increased discrimination in required.

Given an AQL, an inspection level, lot size, and whether single, double, or multiple inspections are to be done, MIL-STD-105D provides a sampling plan. The plan may be normal, reduced, or tightened as results dictate.

Sampling starts with normal inspection. If two out of five consecutive lots are found to be unsatisfactory on original inspection, MIL-STD-105D mandates a shift to tightened inspection. Normal inspection is re-instituted from tightened inspection when five consecutive lots are accepted on original inspection. Should ten consecutive lots fail initial inspection from tightened inspection, inspection is suspended, and corrective action taken.

When in normal inspection, should ten lots be accepted on initial inspection the administrator in charge of quality assurance may opt to shift to reduced inspection. Inspection remains in the reduced mode until a lot fails inspection, or alternatively passes inspection, but the number of rejected units is relatively large. In either case, inspection shifts back to normal inspection.

The starting point for any utilization of MIL-STD-105D is the determination of what proportion of defectives (as given in MIL-STD-105D) is acceptable to the user. This proportion of defectives is called the acceptable quality level or AQL. In his text Quality Control and Industrial Statistics [Ref. 8: pp. 209 -245], Duncan states,

> It is expected that the supplier will be submitting for inspection a series of lots of his product, and it is the purpose of the sampling procedures of Mil. Std. 105D so to constrain the supplier that he will produce product of at least AQL quality. This is done not only through the acceptance and rejection of a particular sampling plan but by providing for a shift to another, tighter sampling plan whenever there is evidence that the contractor's product has deteriorated from the agreed upon AQL.

There is the further provision to shift to another, reduced sampling plan should the contractor consistently produce superior product. This shift to the reduced sampling plan, unlike the shift to the tightened plan described above by Duncan is not mandatory, but is accomplished at the user's option. The AQL's are presented in MIL-STD-105D as fraction-defective plans from 0.01 to 10.0 percent and as defects-per-unit plans from 0.01 to 1000 defects per 100 units.

MIL-STD-105D provides for seven inspection levels, which vary depending on the degree of discrimination required: the more discrimination, the more samples are

attribute is a feature of a service which either matches or fails to match a standard.

D. DISCUSSION OF MIL-STD-105D

Sampling Procedures and Tables for Inspection by Attributes (MIL-STD-105D) [Appendix A] is the current version of standard military sampling procedures for inspection by attributes first developed during World War II. The standard was adopted as a joint service standard in 1950, and was modified twice before discussions with the British and Canadian forces which yielded 105D, issued by the U.S. in 1963. In 1971 MIL-STD-105D was adopted by the American National Standards Institute, becoming ANSI Standard Z 1.4, followed by adoption by the International Standards Organization in 1973 as International Standard ISO/DIS 2859.

In order to implement the tables in MIL-STD-105D, four decisions are normally made prior to utilization:

1. The AQL or acceptable quality level,
2. The inspection level,
3. The lot size, and
4. The type of sampling plan (single, double, or multiple).

discussions of ways and means of correcting the problem, through deducting a certain portion of the contractor's remuneration for each lot found unacceptable, to finally terminating the contract for default.

The procedure for deducting a portion of the contractor's pay is termed deduct analysis. Deduct analysis is performed whenever the contractor's performance for a given day falls below the AQL. In this case, the contractor's fee for the day in question is reduced by a percentage equal to the percentage of samples which were found to be defective. For instance: assume that for a lot size of 100, 20 samples were drawn; of these twenty samples, 5 were found to be defective. These 5 samples represent 25 percent of the total samples drawn. Assuming that this number represents an unacceptable level of performance (as specified in the contract), the Commercial Activities manager will deduct 25 percent of the contractor's fee for the day in question.

As specified in OFPP 4, "The basis for doing random sampling is MIL-STD-105D, Sampling Procedures and Tables for Inspection by Attributes which is widely understood and used by both the government and contractors." This standard is based upon the concept of attributes. An

3. Problem Location. If contractor performance values indicate that the service provided by the contractor is not being adequately performed, Quality Assurance personnel are to use decision tables to locate the problem.

Information for surveillance purposes can come from a variety of sources: management information systems (MIS), random sampling, checklists, and formal customer complaints. Of these four methods, the most commonly applied is random sampling as it does not require the inspection of each individual job.

Using a random sampling technique, Quality Assurance personnel sample the services provided by the contractor (or the same services conducted in-house [Ref. 7: p. A-1]) in order to determine if these services are acceptable. This type of surveillance sampling is called acceptance sampling and is used to determine whether to accept or reject the contractor's performance over a given period of time. In this case, management by exception is utilized in that if the contractor's performance is accepted, no action is taken. Should the contractor's performance prove unsatisfactory, certain actions are taken, depending on the severity and duration of unsatisfactory performance. These actions range from

20 March 1984 the Assistant Secretary of Defense for Manpower, Installations, and Logistics has expanded the scope of this Quality Assurance and Surveillance Plan to require its use by facilities retaining performance of commercial services in-house. This policy requires the same levels of performance of the Navy operated activity as if the contract had been let to a private contractor [Ref. 7: p.A-1].

C. GUIDANCE ON SURVEILLANCE PLANS FROM OFPP 4

Appended as Supplement 2 to OMB Circular No. A-76, Office of Federal Procurement Policy Pamphlet No. 4 [Ref. 5: pp. 43-74] provides specific guidance in the formulation of Quality Assurance and Surveillance Plans for use by Contracts Administration personnel. The pamphlet presents three key ideas as bases for a surveillance plan:

1. Management by Exception. When the government specifies the quality assurance procedure, compliance by the contractor with that QA plan is the desired output service.

2. Performance Indicator. The level of service provided by the contractor is checked and monitored by comparing his performance with the values specified in the Performance Work Statement (PWS).

3. If patient care at a hospital operated by the government would be served best by in-house performance;

4. If the government is operating, or can operate the activity at lower cost than a qualified commercial source.

In order to ensure proper performance by a contractor, Supplement 1 to OMB Circular No. A-76 [Ref. 4: pp. I-1] mandates that Contract Administration personnel develop a Quality Assurance and Surveillance Plan in accordance with Supplement 2 to OMB Circular No. A-76, published separately as Office of Federal Procurement Policy Pamphlet No. 4 (hereafter referred to as OFPP 4). This publication specifies the general methodology for the establishment and conduct of Quality Assurance and Surveillance Programs for use in Commercial Activities Programs [Ref. 5: pp. 43 - 74]. The Commander, Naval Data Automation Command notified NARDAC, San Francisco that even though OFPP 4 is currently under revision, "...The Oct 80 version of OFPP 4 remains in effect until the Office of Management and Budget (OMB) issues an edited, clarified version. No major procedural changes to OFPP 4 are anticipated. Its use is mandatory for all Navy CA cost comparisons." [Ref. 6: p. 2]. In a memorandum dated

key concepts: one, that the government is not in competition with its citizens; and two, that the competitive, free enterprise system is the primary source of national economic strength and that competition enhances quality, economy and productivity.

The government policy set forth in OMB Circular No. A-76 is three-fold: in order to achieve economy and enhance productivity where possible, comparison of the cost of contracting and the cost of in-house performance shall be done to determine who does the work; to retain certain functions in-house as being inherently governmental in nature and not in competition with the commercial sector; and to rely, to the greatest extent possible, on the commercial sector to provide commercial services.

There are certain limitations affecting the scope of OMB Circular No. A-76, but the original document and its supplements apply to all executive agencies. It provides for government performance of a commercial activity under one of the following conditions:

1. If no satisfactory commercial source is available;

2. If the performance of the activity is required for the national defense;

Automation Command tasked NARDAC San Francisco with developing a Commercial Activities (CA) Program in November 1982 [Refs. 2 and 3]. The purpose of the program is to explore the possibility of selected portions of NARDAC's operation being run by a civilian contractor under a service contract whereby the contractor would operate NARDAC, in lieu of military and civilian personnel, using government furnished equipment and supplies. Included in this tasking are the requirements for the Performance Work Statement and Quality Assurance Package to be completed by 1 June 1984 and the entire CA study to be finished and the decision made by 1 October 1985 to contract with a commercial source or to leave the operation of NARDAC San Francisco as an in-house function.

B. DISCUSSION OF OMB CIRCULAR NO. A-76

The Office of Manpower and Budget's Circular No. A-76, Performance of Commercial Activities, [Ref. 4] establishes Federal policy regarding the performance of commercial activities. A commercial activity is defined by OMB Circular No. A-76 as an activity "...which is operated by a Federal executive agency and which provides a product or service which could be obtained from a commercial source. A commercial activity is not a Government function." OMB Circular No. A-76 is based on two

personnel must now utilize the entire contents of each table instead of just one line because the sample size may vary from day to day.

In the preceding discussion, note that the specific attributes which determine whether a sample is accepted or rejected are left undefined. As of this writing, the Commercial Activities (CA) staff has not specifically determined what timeliness or quality standards must be met for each of the different classes of jobs.

Note that in the foregoing discussion it was assumed that single, as opposed to multiple sampling would be utilized. Single sampling has, in fact, been mandated by NARDAC San Francisco.

For the purposes of this application, the CA staff could discern no need for either increased nor decreased discrimination. For this reason, General Inspection Level II (Appendix A, Table I), normal discrimination was selected.

Finally, the CA staff and technical director at NARDAC San Francisco determined that the AQL required for performance of the contract would be 2.5.

B. DIFFICULTIES WITH IMPLEMENTING MIL-STD-105D

In addition to the details covered in the previous section, there remain several problems which must be overcome prior to the implementation of MIL-STD-105D for this application.

The first problem investigated is the level of training required to allow MIL-STD-105D to be used on a daily basis. In order to properly implement the standard and execute the sampling plan, QA supervisory personnel will need to become familiar with the mechanics of the standard: how to determine the sample size; how to generate random samples; when to shift from one inspection level to another; how to determine whether a given lot is accepted or rejected; when to hold the contractor in default; even which of the tables in MIL-STD-105D needs to be used for each of these processes. Given the atmosphere of litigation which currently surrounds Commercial Activities contracts at other Naval facilities, a fairly high level of competence in each of these fields is necessary.

C. IMPLEMENTATION CONSIDERATIONS

From the preceding discussion, we can see that there are several considerations regarding the implementation

of MIL-STD-105D for use by NARDAC to monitor contractor performance.

With the number of samples discussed previously being generated every day, it becomes apparent that our system must be capable of handling large volumes of data. Furthermore, since our hypothetical contractor isn't paid until QA personnel evaluate his performance, he may not tolerate long delays in the evaluation process. Indeed, the NARDAC management and their superiors may want fairly rapid resolution of the QA question on an on-going basis. Since the inspector's reports become part of a record base which can have future legal ramifications, the system must keep track of a large number of records and be able to access them rapidly. From the preceding discussion of the mechanics of MIL-STD-105D, it is evident that the system must be not only adaptable, but must handle the changing circumstances occasioned by a shift in inspection level quickly and accurately. Finally, the implementation must be secure from unauthorized access by any person who may be connected with the contractor. This is due to the fact that information regarding which samples are to be drawn for inspection is extremely sensitive. Should an unscrupulous contractor gain access to this information, it is not inconceivable that he could, in some manner, alter the record numbers

and submit jobs for inspection which he had previously checked himself to ensure their correctness and timeliness. This would of course, defeat the purpose of the random sampling process, as only those jobs he knew to be perfect would ever be examined.

The preceding discussion suggests that some form of automated implementation may improve the accuracy with which MIL-STD-105D is implemented, as well as aid in the retrievability of the information stored.

D. FACILITIES FOR AUTOMATED IMPLEMENTATION OF MIL-STD-105D

The existing ADP facilities at a regional data processing center would at first glance appear to offer almost unlimited resources for an automated implementation of the project. It is important to remember that the bulk of ADP equipment and programs will be under the direct control of the contractor, however, and as such the opportunities for breaching the security of the quality assurance system are legion. There remains a mainframe computer (which will remain under military control even in the event of NARDAC operations being placed under civilian contract) and several stand-alone microcomputers.

There are many advantages to using the mainframe over the microcomputer execution speed, CPU power, file capacity and system reliability to name only the most obvious. Unfortunately, a security problem remains. While the mainframe under discussion remains under military control and is physically separate from the ADP facilities which would be under the contractor's control, it can be electronically linked to that equipment using existing telecommunications procedures. This opens the possibility of an unscrupulous contractor using this telecommunications capability to effect the system compromise previously discussed.

The microcomputers currently available at NARDAC are standard Z-80 based, 8-bit machines with 64 kilobytes of internal random access memory. The machines are of normal commercial manufacture. Most feature two 384 kilobyte 5 1/4 inch floppy minidisk drives for secondary storage. There is a library of bundled software which accompanies each machine, as well as some add-on software packages the command has purchased. Included among these is dBASE II, a well known relational database management system for microcomputers from Ashton-Tate Software.

E. IMPLEMENTATION SUMMARY

To summarize the implementation strategy thus far, the decisions have been made to:

1. Define a lot as the output of the center for one day, from 0000 to 2359, local time.

2. Conduct single inspection of samples.

3. Utilize General Inspection Level II.

4. Investigate the possibilities of implementing MIL-STD-105D on the command's microcomputers, utilizing the database management system (DBMS) dBASE II.

IV. PROJECT SPECIFICATIONS

A. NARDAC REQUIREMENTS

Specific requirements for implementing MIL-STD-105D were defined during a series of discussions with NARDAC personnel. These requirements tended to center about input and output specifications, questions regarding random number generation, and overall project feasibility. NARDAC's system specifications are summarized below:

1. The system as implemented must generate its own random numbers for sample selection. As a corollary to this requirement, it was mutually decided upon that there would be no transparent "seed" or starting point to be input which would be subject to manipulation. A secret or hidden seed was deemed acceptable. The random numbers are to be used to notify which jobs are to be inspected.

2. The system must store the results of the inspection process for future use. Storage on floppy disk was judged to be satisfactory for this requirement. Furthermore, data stored on the disks must be available in a variety of formats, not all of which are presently known.

3. The system inself must be adaptable to future change without undue difficulty in reprogramming effort. For instance, as new formats for data become known, the system should be capable of responding with modular output formats with little system perturbation. Other contemplated changes in the system will be discussed later in this work.

4. The system must be usable by individuals not necessarily computer literate, or at least be usable with a minimum of training. The system must communicate with the users in plain English, not "computerese".

5. In its initial form the system must generate report forms for the quality assurance inspectors to fill out for each job to be sampled. There are two such forms, one for the inspection of the job's timeliness and one for the job's quality. The timeliness report is used for every job, while the quality report is used for those jobs having actual physical output. When the system is fully implemented, it is anticipated that pre-printed report forms will be obtained and the only input to them will be the sample identification.

6. The jobs selected for sampling will be identified by a composite identification number called an

Inspection Requirement Report or IRR. The IRR shall consist of the Julian date the job was completed in the format YYDDD (January 20, 1984 would therefore be 84020), the local time the job was completed in twenty-four hour notation and the job's record number, for instance: 84020 1345 34876

7. The system must be able to input inspection results from any day previously specified.

8. The system must analyze the results of the inspection process in accordance with MIL-STD-105D and make available the following information:

(A). The inspection level recommended for the current day's inspection plan,

(B). The random samples to be inspected,

(C). Whether to accept or reject the contractor's efforts for the day in question, and

(D). The inspection level recommended for the next day's efforts.

9. Should the contractor's efforts be rejected, the system must conduct deduct analysis to determine the amount to be deducted from his compensation for the day in question. In the event the contractor has

failed ten successive days in tightened inspection, the system should notify QA personnel that inspection is to be discontinued in accordance with MIL-STD-105D and that the contractor is in default.

This analysis should include all elements of MIL-STD-105D given the decisions summarized in Chapter III, Section E of this thesis.

B. ADDITIONAL REQUIREMENTS

In response to some of the requirements specified by NARDAC in the preceding section, and as coding of the project progressed, some additional system requirements became known.

1. Design of the program must be modular in order to allow for system maintenance and modification.

2. The system must be menu-driven to allow operation by personnel who are not familiar with it's programming.

3. Since the lot size is determined by the size of one day's output, the date, expressed in Julian terms, will be a major system key, whereby several decisions are made during system operation. In this sense, the system can be said to be "date-driven".

4. Security is to be effected by the use of stand-alone microcomputers, whose only connection with the contractor will be via modems; such connection is to be completed only by QA personnel and terminated immediately upon receipt of the desired information (lot size and record identification numbers). Since these microcomputers at NARDAC San Francisco can be made physically secure, and access to them and their software limited to authorized personnel, it may be assumed that they exist in a benign environment.

5. The total day's run for each day would not reside in microcomputer files; rather, such files will contain only those samples selected for inspection and the results of the inspection process.

V. SYSTEM DESIGN

A. DESIGN METHODOLOGY

The basic design methodology used in the design of the system was the modified version of stepwise refinement (or top-down design) described by Sommerville [Ref. 9: pp. 38-77]. Briefly, the steps included:

1. Study and understanding of the problem,

2. Identification of the gross features of at least one possible solution, with no consideration of low-level implementation details,

3. Construction of a data flow diagram showing gross data transformations in the system,

4. Construction of structure charts showing the program units involved in the solution, and

5. Modular implementation of the program units in the programming language.

Following the notational system presented by Modes [Ref. 10], data-flow diagrams and structure charts were combined as one unit and expanded as necessary to achieve clarity of design. After validation and verification of system feasibility, program coding in the programming language began.

B. DESIGN RESULTS, SYSTEM OVERVIEW

The data-flow diagrams for the system are presented in Appendix B. The system overview is shown as Figure 1. The results are summarized below and will be discussed in detail in the sections dealing with the first expansion of the system design. At this point in the design phase the system was named the Automated Quality Assurance System (AQAS).

1. Examination of the system overview shows the following system inputs:

   (A). Date. Date is entered in the Julian notation previously described.

   (B). System Commands. There are several of these, defining the systems operation.

   (C). Sample Information. Information needed to compute the random samples.

   (D). Sample Designation and Inspection Results. From the Input module.

2. The following system outputs are generated.

   (A). Menu messages, notifying the user of system actions enabling the user to input needed information and to output results.

(B). Sample list, a listing of the jobs to be inspected.

(C). Timeliness Report Forms, one per job.

(D). Quality Report Forms, one per job where there is actual physical output.

(E). Error messages as needed.

(F). Inspection results as either a current status report, or a termination report.

C. DESIGN RESULTS, FIRST EXPANSION

The first design expansion of the Automated Quality Assurance System (Appendix B, Figure 2) shows the inter-relationships between the principal system modules and their major inputs and outputs. The principal system modules are Main, Select, Input, Analyze, and Utility with the Main module the central module of the system, from which all subordinate modules depend.

The Main module (or Main Menu) [Fig. 2] is automatically called from Sinon (itself automatically called when initializing the system). Sinon is nothing more than a welcome screen. Main is the module which calls the other modules and to which they default upon completion of their tasks. Note that in each case, the subordinate

14. Green, Adam B., dBASE II User's Guide, Software Banc, 1983

15. Freedman, Alan., dBASE II for the First-Time User, Ashton-Tate, 1984

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2. Commander, Naval Data Automation Command, Washington, D.C., letter Ser 90-497/2949 of 24 November, 1982, Commercial Activities Program Tasking.

3. Commander, Naval Data Automation Command, Washington, D.C., letter Ser. 90-168/1167 of 29 April, 1983, Commercial Activities Program Tasking.

4. Office of Manpower and Budget, Washington, D.C., Circular No. A-76, Performance of Commercial Activities, 1983

5. Supplement No.2 to OMB Circular No. A-76, A Guide for Writing and Administering Performance Work Statements of Work for Service Contracts, 1980.

6. Commander, Naval Data Automation Command, Washington, D.C., letter Ser. 90-164/1626 of 12 April, 1984, Commercial Activities (CA) Program Advisory.

7. Assistant Secretary of Defense, Washington, D.C., memorandum dated 20 March, 1984, Implementation of Revised OMB Circular A-76 in the Department of Defense ACTION MEMORANDUM

8. Duncan, Acheson J., Quality Control and Industrial Statistics, Richard D. Irwin, Inc., 1974

9. Sommerville, I., Software Engineering, Addison-Wesley Publishing Co., 1982

10. Modes, Ronald W., Naval Postgraduate School Classroom discussion on Software Design, 1983

11. Graham, Neill., Introduction to Computer Science - A Structured Approach, West Publishing Co., 1982

12. Ratliff, Wayne., dBASE II Assembly Language Relational Database Management System User Manual, Ashton-Tate, 1984

13. Byers, Robert A., dBASE II For Every Business, Ashton-Tate, 1983

some of the files in AQAS to enable their systems to accept its several modules.

4. As this program was developed for NARDAC San Francisco, inquiries regarding AQAS implementation may be addressed to :

Commanding Officer
NARDAC San Francisco
Building 8-1, Code 50X
NAS Alameda, CA 94501

Attn: Mr. Al Hinds

needs more error handling routines; the option should exist for the user to exit from the menu driven input mode and input results more directly in order to facilitate the input process; and the utility programs need to be defined and effected. To the end users are left these exercises.

C. NOTES TO USERS

1. The format FILENAME.CMD is used when dBASE II is implemented on a micrccomputer using the CP/M operating system. For users wishing to utilize 16 bit architectures the format is FILENAME.PRG.

2. The random number generator found in Randgen has been modified somewhat from its presentation in this work to preclude its access by unauthorized personnel. While the function remains the same, a "confuser" has been added so that the values of seed are not so straightforward as appear here.

3. The CP/M operating system as modified by Morrow for use in their MD3 microcomputers allows for over 120 dictionary entries, far more than the 64 entries allowed by unmodified versions of CP/M. End users may need to either modify similarly their versions of CP/M or merge

VII. EVALUATION

A. CONCLUSIONS

AQAS was successfully implemented using the methodology, equipment, and software described previously. The design allows the quality assurance administrator to utilize MIL-STD-105D on a continuing basis with no fear of making mistakes in implementation, at the same time permitting any user to generate random samples, input data and analyze results.

Although this system was tailored to the application peculiar to NARDAC, San Francisco, it remains applicable to other NARDACS contemplating converting operations to commercial service contracts under OMB Circular No. A-76. Furthermore, it remains in essence nothing but an automated form of MIL-STD-105D with input and report generation capabilities tailored to a specific application. As such, given its modular design and documentation, it should be reasonably easy to convert to other applications requiring statistical quality control utilizing MIL-STD-105D.

B. RECOMMENDATIONS

As with any software project, the software designer can always find modifications and enhancements he would like to implement, and AQAS is no exception. The system

repeated telephone calls to Ashton-Tate resolved this relatively simple matter. The final solution to the problem was provided by NARDAC personnel.

While the benefits of a menu-driven system for non-technical users are evident, the fairly slow nature of the input process using a menu system is annoying. While there exists no easy solution for this problem, this is one area in AQAS that would benefit from further study.

insufficient, consisting of advice to purchase an after-market tutorial to explain the system to the programmer [Ref. 14]. These considerations notwithstanding, dBASE II proved adequate for the implementation of AQAS.

C. CODING AQAS

The actual task of programming the Automated Quality Assurance System went smoothly. The entire system code is included as Appendix C. There follow some remarks regarding matters which arose during the course of programming.

One of the difficulties encountered was in ensuring that the random numbers generated in Randgen were unique. For instance, given a lot size of 4 and a sample size of 2, a program which calls for inspecting item 3 twice is not functioning properly. Ensuring that the program would not do this took considerable effort.

Another feature that took a considerable effort to effect was the inclusion of a memory variable in a report form. REPORT is a function of dBASE II which allows for the output of database information in a pre-specified format. This was one area where Ashton-Tate's poor documentation and poorer customer service were particularly irksome. Neither the system manual nor

programming, while at the same time allowing unstructured programming practices. This is a mixed blessing as it tends to allow marginal programs to run acceptably, while preventing the benefits in error correction that true structured programming possesses. If good programming practices are followed, however, it does support structured, modular programming. Aside from some limitations on file, record, field and string length it is a powerful database management system (DBMS). There are four disadvantages to its use, however. In no way could one consider dBASE II to be a real-time system. In the NARDAC implementation (Morrow MD-3 microcomputers) the average time required to generate 200 samples for 10,000 events was two and one half minutes. Secondly, it supports only very elementary mathematics. This presented a limitation to the implementation of AQAS in that many of the pseudo-random number generators rely heavily on the use of logarithms. Third, the documentation for dBASE II is poor, at best. Massive in scope, it still fails to present all the power of the language. The system manual [Ref. 12] accompanying the software appears to be written for someone who is thoroughly conversant with the language and has no need for the documentation. Ashton-Tate seems to be relying on after-market documentation to explain the system to its users [Refs. 13 and 14]. Finally, customer support from Ashton-Tate was

VI. SYSTEM CODING

A. INTRODUCTION TO dBASE II

dBASE II is a relational database management system for microcomputers. Originally developed as VULCAN by Wayne Ratliff at Caltech's Jet Propulsion Laboratory, the system is currently marketed commercially by Ashton-Tate. dBASE II requires the following hardware and software configuration:

1. 8080, 8085, or Z-80 based microprocessor system equipped with CP/M, CDOS, or CROMIX operating systems or 8086 or 8088 based microprocessor system equipped with CP/M-86 or MSDOS operating systems.

2. 48 kilobytes of memory (RAM).

3. One or more mass storage devices (minidisks, etc).

4. A cursor-addressable CRT for full screen operations.

5. For some applications (including AQAS), a text printer is required.

B. dBASE II AS A PROGRAMMING LANGUAGE

dBASE II presents some aspects of both procedural and non-procedural languages in that it supports structured

returns to Analyze, which now calls Insprpt. Insprpt's sole function is to output one of two messages: Statrpt reports to the user the date just analyzed, the number of samples, the number of samples failing inspection, the number of jobs processed by the contractor, what the experienced failure rate is, what the results of the inspection were (accepted or rejected), and the recommended level for the next day's inspection efforts. Termrpt notifies QA personnel that samples from ten previous days have failed inspection, and that sampling should be stopped and the contract terminated.

The last module to be discussed is the Utility module [Fig. 6], which currently consists solely of a program stub, as the exact format of additional reports is unknown. Utility provides expansion space to allow for the development of custom reports.

efforts for the day in question in accordance with MIL-STD-105D. In addition to making this determination, the system also determines the recommended inspection level for the next day in the case where the current day's inspection was conducted under the reduced inspection level. This is done at this time because only at the reduced inspection level does the possibility exist for both the lot to be accepted, and the inspection level to become more stringent, i.e.: go from reduced to normal. Because this decision is based on the number of samples failing inspection it is logical to place this determination at this location.

After Sampanal has completed and returned to Analyze, that module calls Inspanal. Inspanal's purpose is to determine the recommended inspection level in the cases where the current day's inspection was conducted in the normal or tightened mode. This is not done in the same manner as this same determination for the reduced inspection just discussed because its operation under MIL-STD-105D is different and to include this relatively lengthy step for each case in Sampanal would make for a very inefficient program. Inspanal performs the same functional task, however, returning a value for the recommended inspection level for the next day's inspection efforts. After completing this task, it too

delivered, whether the sample passed the timeliness inspection and, if not, whether this was the result of a failure of the computer system or of the government, whether the sample passed the quality inspection and, if not, was the problem one of accuracy of results or of print quality. When the user has completed his input actions, he returns to Main. Note that in each of these modules, it is possible to specify the date with Setjuln.

The next module is the sequence is the Analyze module [Fig 5.] which takes data previously input, and analyzes it. The first thing this module does upon execution is to run a version of Setjuln called Analyze.Fmt. Analyze.Fmt performs the same functions as Setjuln, but also displays a message to the user regarding system operation at this time. After getting the date to be analyzed from the user, Analyze automatically steps through several subordinate modules. The first of these is Sampchek which ensures that all samples for the specified date have been entered. It then checks to ensure that all reports for all samples have been entered. If either a sample or a report has been omitted, Sampchek displays an error message and returns the user to Input to input the missing information. Assuming that there is no missing data, the next module from Analyze is Sampanal which determines whether to accept or reject the contractor's

algorithm which produces them from a hidden value, or seed [Ref. 11: pp. 184]. Randgen then compares the random number generated with the number of events to determine the event number to be inspected. Randgen ensures that the event number is unique before storing it to a database file. After Randgen has completed this cycle as many times as there are samples to be taken, it returns to Select. Select then calls Notify which indexes the event numbers (puts them in numerical order) and prints a list giving the day's Julian date and a list of the event numbers to be sampled. Notify returns to Select, which in turn returns to Main.

The next module normally called by the user would be Input [Fig. 4]. Input has two functions: to input to a database file all the events selected for inspection, then in a separate action, to input the results of the inspection process. This is accomplished first by calling a subordinate module called Sampspec which accomplishes the first action, then when all samples have been entered for the specified day, the user may opt to input inspection results. This is accomplished through the Inspres module which allows the user to define the sample for which he is inputting inspection results, then allows the user to input the inspection results. The inspection results include the site where the product was

modules are called by a simple command, with no memory variables being used. This is to preserve the modularity of the system and to increase system flexibility in terms of dealing with more than one date per subordinate module call. The date is a major system delimiter, as will be seen shortly.

Select [Fig. 2] is, in many respects, the "heart" of AQAS. It is here that the entire problem of random number generation and sample selection is solved. Seen for the first time in Select is Setjuln, the module which allows input of the date in question. Setjuln will be seen in several modules as the program develops. After the user defines the date with Setjuln, Select informs him of the recommended inspection level (Rcmdinsp), asks him for the number of events (in this discussion, events equate to jobs) and finally, what inspection level is to be used. Note that the system does not mandate the inspection level for the day, since the shift to reduced inspection is both a function of MIL-STD-105D and management option. After receipt of this information, Select calls Sampgen which states the number of samples to be taken in accordance with MIL-STD-105D and stores this information to a memory variable. Select then calls Randgen to generate "random" numbers. The numbers generated are actually pseudorandom in that there is an arithmetic

APPENDIX A

MIL-STD-105D

TABLES

SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

1. SCOPE

1.1 **PURPOSE.** This publication establishes sampling plans and procedures for inspection by attributes. When specified by the responsible authority, this publication shall be referenced in the specification, contract, inspection instructions, or other documents and the provisions set forth herein shall govern. The "responsible authority" shall be designated in one of the above documents.

1.2 **APPLICATION.** Sampling plans designated in this publication are applicable, but not limited, to inspection of the following:

a. End items.

b. Components and raw materials.

c. Operations.

d. Materials in process.

e. Supplies in storage.

f. Maintenance operations.

g. Data or records.

h. Administrative procedures.

These plans are intended primarily to be used for a continuing series of lots or batches. The plans may also be used for the inspection of isolated lots or batches, but, in this latter case, the user is cautioned to consult the operating characteristic curves to find a plan which will yield the desired protection (see 11.6).

1.3 **INSPECTION.** Inspection is the process of measuring, examining, testing, or otherwise comparing the unit of product (see 1.5) with the requirements.

1.4 **INSPECTION BY ATTRIBUTES.** Inspection by attributes is inspection whereby either the unit of product is classified simply as defective or nondefective, or the number of defects in the unit of product is counted, with respect to a given requirement or set of requirements.

1.5 **UNIT OF PRODUCT.** The unit of product is the thing inspected in order to determine its classification as defective or nondefective or to count the number of defects. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may or may not be the same as the unit of purchase, supply, production, or shipment.

2. CLASSIFICATION OF DEFECTS AND DEFECTIVES

2.1 METHOD OF CLASSIFYING DEFECTS. A classification of defects is the enumeration of possible defects of the unit of product classified according to their seriousness. A defect is any nonconformance of the unit of product with specified requirements. Defects will normally be grouped into one or more of the following classes; however, defects may be grouped into other classes, or into subclasses within these classes.

2.1.1 CRITICAL DEFECT. A critical defect is a defect that judgment and experience indicate is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product; or a defect that judgment and experience indicate is likely to prevent performance of the tactical function of a major end item such as a ship, aircraft, tank, missile or space vehicle. NOTE: For a special provision relating to critical defects, see 6.3.

2.1.2 MAJOR DEFECT. A major defect is a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose.

2.1.3 MINOR DEFECT. A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit.

2.2 METHOD OF CLASSIFYING DEFECTIVES. A defective is a unit of product which contains one or more defects. Defectives will usually be classified as follows:

2.2.1 CRITICAL DEFECTIVE. A critical defective contains one or more critical defects and may also contain major and or minor defects. NOTE: For a special provision relating to critical defectives, see 6.3.

2.2.2 MAJOR DEFECTIVE. A major defective contains one or more major defects, and may also contain minor defects but contains no critical defect.

2.2.3 MINOR DEFECTIVE. A minor defective contains one or more minor defects but contains no critical or major defect.

3. PERCENT DEFECTIVE AND DEFECTS PER HUNDRED UNITS

3.1 EXPRESSION OF NONCONFORMANCE. The extent of nonconformance of product shall be expressed either in terms of percent defective or in terms of defects per hundred units.

3.2 PERCENT DEFECTIVE. The percent defective of any given quantity of units of product is one hunderd times the number of defective units of product contained therein divided by the total number of units of product, i.e.:

$$\text{Percent defective} = \frac{\text{Number of defectives}}{\text{Number of units inspected}} \cdot 100$$

3.3 DEFECTS PER HUNDRED UNITS. The number of defects per hundred units of any given quantity of units of product is one hundred times the number of defects contained therein (one or more defects being possible in any unit of product) divided by the total number of units of product, i.e.:

$$\text{Defects per hundred units} = \frac{\text{Number of defects}}{\text{Number of units inspected}} \times 100$$

4. ACCEPTABLE QUALITY LEVEL (AQL)

4.1 USE. The AQL, together with the Sample Size Code Letter, is used for indexing the sampling plans provided herein.

4.2 DEFINITION. The AQL is the maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average (see 11.2).

4.3 NOTE ON THE MEANING OF AQL. When a consumer designates some specific value of AQL for a certain defect or group of defects, he indicates to the supplier that his (the consumer's) acceptance sampling plan will accept the great majority of the lots or batches that the supplier submits, provided the process average level of percent defective (or defects per hundred units) in these lots or batches be no greater than the designated value of AQL. Thus, the AQL is a designated value of percent defective (or defects per hundred units) that the consumer indicates will be accepted most of the time by the acceptance sampling procedure to be used. The sampling plans provided herein are so arranged that the probability of acceptance at the designated AQL value depends upon the sample size, being generally higher for large samples than for small ones, for a given AQL. The AQL alone does not describe the protection to the consumer for individual lots or batches but more directly relates to what might be expected from a series of lots or batches, provided the steps indicated in this publication are taken. It is necessary to refer to the operating characteristic curve of the plan, to determine what protection the consumer will have.

4.4 LIMITATION. The designation of an AQL shall not imply that the supplier has the right to supply knowingly any defective unit of product.

4.5 SPECIFYING AQLs. The AQL to be used will be designated in the contract or by the responsible authority. Different AQLs may be designated for groups of defects considered collectively, or for individual defects. An AQL for a group of defects may be designated in addition to AQLs for individual defects, or subgroups, within that group. AQL values of 10.0 or less may be expressed either in percent defective or in defects per hundred units; those over 10.0 shall be expressed in defects per hundred units only.

4.6 PREFERRED AQLs. The values of AQLs given in these tables are known as preferred AQLs. If, for any product, an AQL be designated other than a preferred AQL, these tables are not applicable.

5. SUBMISSION OF PRODUCT

5.1 LOT OR BATCH. The term lot or batch shall mean "inspection lot" or "inspection batch," i.e., a collection of units of product from which a sample is to be drawn and inspected to determine conformance with the acceptability criteria, and may differ from a collection of units designated as a lot or batch for other purposes (e.g., production, shipment, etc.).

5.2 FORMATION OF LOTS OR BATCHES. The product shall be assembled into identifiable lots, sublots, batches, or in such other manner as may be prescribed (see 5.4). Each lot or batch shall, as far as is practicable,

5. SUBMISSION OF PRODUCT (Continued)

consist of units of product of a single type, grade, class, size, and composition, manufactured under essentially the same conditions, and at essentially the same time.

5.3 LOT OR BATCH SIZE. The lot or batch size is the number of units of product in a lot or batch.

5.4 PRESENTATION OF LOTS OR BATCHES. The formation of the lots or batches, lot or batch size, and the manner in which each lot or batch is to be presented and identified by the supplier shall be designated or approved by the responsible authority. As necessary, the supplier shall provide adequate and suitable storage space for each lot or batch, equipment needed for proper identification and presentation, and personnel for all handling of product required for drawing of samples.

6. ACCEPTANCE AND REJECTION

6.1 ACCEPTABILITY OF LOTS OR BATCHES. Acceptability of a lot or batch will be determined by the use of a sampling plan or plans associated with the designated AQL or AQLs.

6.2 DEFECTIVE UNITS. The right is reserved to reject any unit of product found defective during inspection whether that unit of product forms part of a sample or not, and whether the lot or batch as a whole is accepted or rejected. Rejected units may be repaired or corrected and resubmitted for inspection with the approval of, and in the manner specified by, the responsible authority.

6.3 SPECIAL RESERVATION FOR CRITICAL DEFECTS. The supplier may be required at the discretion of the responsible authority to inspect every unit of the lot or batch for critical defects. The right is reserved to inspect every unit submitted by the supplier for critical defects, and to reject the lot or batch immediately, when a critical defect is found. The right is reserved also to sample, for critical defects, every lot or batch submitted by the supplier and to reject any lot or batch if a sample drawn therefrom is found to contain one or more critical defects.

6.4 RESUBMITTED LOTS OR BATCHES. Lots or batches found unacceptable shall be resubmitted for reinspection only after all units are re-examined or retested and all defective units are removed or defects corrected. The responsible authority shall determine whether normal or tightened inspection shall be used, and whether reinspection shall include all types or classes of defects or for the particular types or classes of defects which caused initial rejection.

7. DRAWING OF SAMPLES

7.1 SAMPLE. A sample consists of one or more units of product drawn from a lot or batch, the units of the sample being selected at random without regard to their quality. The number of units of product in the sample is the sample size.

7.2 REPRESENTATIVE SAMPLING. When appropriate, the number of units in the sample shall be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion.

7. DRAWING OF SAMPLES (Continued)

When representative sampling is used, the units from each part of the lot or batch shall be selected at random.

7.3 TIME OF SAMPLING. Samples may be drawn after all the units comprising the lot or batch have been assembled, or samples may be drawn during assembly of the lot or batch.

7.4 DOUBLE OR MULTIPLE SAMPLING. When double or multiple sampling is to be used, each sample shall be selected over the entire lot or batch.

8. NORMAL, TIGHTENED AND REDUCED INSPECTION

8.1 INITIATION OF INSPECTION. Normal inspection will be used at the start of inspection unless otherwise directed by the responsible authority.

8.2 CONTINUATION OF INSPECTION. Normal, tightened or reduced inspection shall continue unchanged for each class of defects or defectives on successive lots or batchs except where the switching procedures given below require change. The switching procedures given below require a change. The switching procedures shall be applied to each class of defects or defectives independently.

8.3 SWITCHING PROCEDURES.

8.3.1 NORMAL TO TIGHTENED. When normal inspection is in effect, tightened inspection shall be instituted when 2 out of 5 consecutive lots or batches have been rejected on original inspection (i.e., ignoring resubmitted lots or batches for this procedure).

8.3.2 TIGHTENED TO NORMAL. When tightened inspection is in effect, normal inspection shall be instituted when 5 consecutive lots or batches have been considered acceptable on original inspection.

8.3.3 NORMAL TO REDUCED. When normal inspection is in effect, reduced inspection shall be instituted providing that all of the following conditions are satisfied:

a. The preceding 10 lots or batches (or more, as indicated by the note to Table VIII) have been on normal inspection and none has been rejected on original inspection; and

b. The total number of defectives (or defects) in the samples from the preceding 10 lots or batches (or such other number as was used for condition "a" above) is equal to or less than the applicable number given in Table VIII. If double or multiple sampling is in use, all samples inspected should be included, not "first" samples only; and

c. Production is at a steady rate; and

d. Reduced inspection is considered desirable by the responsible authority.

8.3.4 REDUCED TO NORMAL. When reduced inspection is in effect, normal inspection shall be instituted if any of the following occur on original inspection:

a. A lot or batch is rejected; or

b. A lot or batch is considered acceptable under the procedures of 10.1.4; or

c. Production becomes irregular or delayed; or

d. Other conditions warrant that normal inspection shall be instituted.

8.4 DISCONTINUATION OF INSPECTION. In the event that 10 consecutive lots or batches remain on tightened inspection (or such other number as may be designated by the responsible authority), inspection under the provisions of this document should be discontinued pending action to improve the quality of submitted material.

9. SAMPLING PLANS

9.1 SAMPLING PLAN. A sampling plan indicates the number of units of product from each lot or batch which are to be inspected (sample size or series of sample sizes) and the criteria for determining the acceptability of the lot or batch (acceptance and rejection numbers).

9.2 INSPECTION LEVEL. The inspection level determines the relationship between the lot or batch size and the sample size. The inspection level to be used for any particular requirement will be prescribed by the responsible authority. Three inspection levels: I, II, and III, are given in Table I for general use. Unless otherwise specified, Inspection Level II will be used. However, Inspection Level I may be specified when less discrimination is needed, or Level III may be specified for greater discrimination. Four additional special levels: S–1, S–2, S–3 and S–4, are given in the same table and may be used where relatively small sample sizes are necessary and large sampling risks can or must be tolerated.

NOTE: In the designation of inspection levels S–1 to S–4, care must be exercised to avoid AQLs inconsistent with these inspection levels.

9.3 CODE LETTERS. Sample sizes are designated by code letters. Table I shall be used to find the applicable code letter for the particular lot or batch size and the prescribed inspection level.

9.4 OBTAINING SAMPLING PLAN. The AQL and the code letter shall be used to obtain the sampling plan from Tables II, III or IV. When no sampling plan is available for a given combination of AQL and code letter, the tables direct the user to a different letter. The sample size to be used is given by the new code letter not by the original letter. If this procedure leads to different sample sizes for different classes of defects, the code letter corresponding to the largest sample size derived may be used for all classes of defects when designated or approved by the responsible authority. As an alternative to a single sampling plan with an acceptance number of 0, the plan with an acceptance number of 1 with its correspondingly larger sample size for a designated AQL (where available), may be used when designated or approved by the responsible authority.

9.5 TYPES OF SAMPLING PLANS. Three types of sampling plans: Single, Double and Multiple, are given in Tables II, III and IV, respectively. When several types of plans are available for a given AQL and code letter, any one may be used. A decision as to type of plan, either single, double, or multiple, when available for a given AQL and code letter, will usually be based upon the comparison between the administrative difficulty and the average sample sizes of the available plans. The average sample size of multiple plans is less than for double (except in the case corresponding to single acceptance number 1) and both of these are always less than a single sample size. Usually the administrative difficulty for single sampling and the cost per unit of the sample are less than for double or multiple.

10. DETERMINATION OF ACCEPTABILITY

10.1 PERCENT DEFECTIVE INSPECTION. To determine acceptability of a lot or batch under percent defective inspection, the applicable sampling plan shall be used in accordance with 10.1.1, 10.1.2, 10.1.3, 10.1.4, and 10.1.5.

10.1.1 SINGLE SAMPLING PLAN. The number of sample units inspected shall be equal to the sample size given by the plan. If the number of defectives found in the sample is equal to or less than the acceptance number, the lot or batch shall be considered acceptable. If the number of defectives is equal to or greater than the rejection number, the lot or batch shall be rejected.

10.1.2 DOUBLE SAMPLING PLAN. The number of sample units inspected shall be equal to the first sample size given by the plan. If the number of defectives found in the first sample is equal to or less than the first acceptance number, the lot or batch shall be considered acceptable. If the number of defectives found in the first sample is equal to or greater than the first rejection number, the lot or batch shall be rejected. If the number of defectives found in the first sample is between the first acceptance and rejection numbers, a second sample of the size given by the plan shall be inspected. The number of defectives found in the first and second samples shall be accumulated. If the cumulative number of defectives is equal to or less than the second acceptance number, the lot or batch shall be considered acceptable. If the cumulative number of defectives is equal to or greater than the second rejection number, the lot or batch shall be rejected.

10.1.3 MULTIPLE SAMPLE PLAN. Under multiple sampling, the procedure shall be similar to that specified in 10.1.2, except that the number of successive samples required to reach a decision may be more than two.

10.1.4 SPECIAL PROCEDURE FOR REDUCED INSPECTION. Under reduced inspection, the sampling procedure may terminate without either acceptance or rejection criteria having been met. In these circumstances, the lot or batch will be considered acceptable, but normal inspection will be reinstated starting with the next lot or batch (see 8.3.4 (b)).

10.2 DEFECTS PER HUNDRED UNITS INSPECTION. To determine the acceptability of a lot or batch under Defects per Hundred Units inspection, the procedure specified for Percent Defective inspection above shall be used, except that the word "defects" shall be substituted for "defectives."

11. SUPPLEMENTARY INFORMATION

11.1 OPERATING CHARACTERISTIC CURVES. The operating characteristic curves for normal inspection, shown in Table X (page 30-62), indicate the percentage of lots or batches which may be expected to be accepted under the various sampling plans for a given process quality. The curves shown are for single sampling; curves for double and multiple sampling are matched as closely as practicable. The O. C. curves shown for AQLs greater than 10.0 are based on the Poisson distribution and are applicable for defects per hundred units inspection; those for AQLs of 10.0 or less and sample sizes of 80 or less are based on the binomial distribution and are applicable for percent defec-

tive inspection; those for AQLs of 10.0 or less and sample sizes larger then 80 are based on the Poisson distribution and are applicable either for defects per hundred units inspection, or for percent defective inspection (the Poisson distribution being an adequate approximation to the binomial distribution under these conditions). Tabulated values, corresponding to selected values of probabilities of acceptance (P_a, in percent) are given for each of the curves shown, and, in addition, for tightened inspection, and for defects per hundred units for AQLs of 10.0 or less and sample sizes of 80 or less.

11.2 PROCESS AVERAGE. The process average is the average percent defective or average number of defects per hundred units (whichever is applicable) of product submitted by the supplier for original inspection. Original inspection is the first inspection of a particular quantity of product as distinguished from the inspection of product which has been resubmitted after prior rejection.

11.3 AVERAGE OUTGOING QUALITY (AOQ). The AOQ is the average quality of outgoing product including all accepted lots or batches, plus all rejected lots or batches after the rejected lots or batches have been effectively 100 percent inspected and all defectives replaced by nondefectives.

11.4 AVERAGE OUTGOING QUALITY LIMIT (AOQL). The AOQL is the maximum of the AOQs for all possible incoming qualities for a given acceptance sampling plan. AOQL values are given in Table V-A for each of the single sampling plans for normal inspection and in Table V-B for each of the single sampling plans for tightened inspection.

11.5 AVERAGE SAMPLE SIZE CURVES. Average sample size curves for double and multiple sampling are in Table IX. These show the average sample sizes which may be expected to occur under the various sampling plans for a given process quality. The curves assume no curtailment of inspection and are approximate to the extent that they are based upon the Poisson distribution, and that the sample sizes for double and multiple sampling are assumed to be 0.631n and 0.25n respectively, where n is the equivalent single sample size.

11.6 LIMITING QUALITY PROTECTION. The sampling plans and associated procedures given in this publication were designed for use where the units of product are produced in a continuing series of lots or batches over a period of time. However, if the lot or batch is of an isolated nature, it is desirable to limit the selection of sampling plans to those, associated with a designated AQL value, that provide not less than a specified limiting quality protection. Sampling plans for this purpose can be selected by choosing a Limiting Quality (LQ) and a consumer's risk to be associated with it. Tables VI and VII give values of LQ for the commonly used consumer's risks of 10 percent and 5 percent respectively. If a different value of consumer's risk is required, the O.C. curves and their tabulated values may be used. The concept of LQ may also be useful in specifying the AQL and Inspection Levels for a series of lots or batches, thus fixing minimum sample size where there is some reason for avoiding (with more than a given consumer's risk) more than a limiting proportion of defectives (or defects) in any single lot or batch.

TABLE 1—Sample size code letters

(See 9.2 and 9.3)

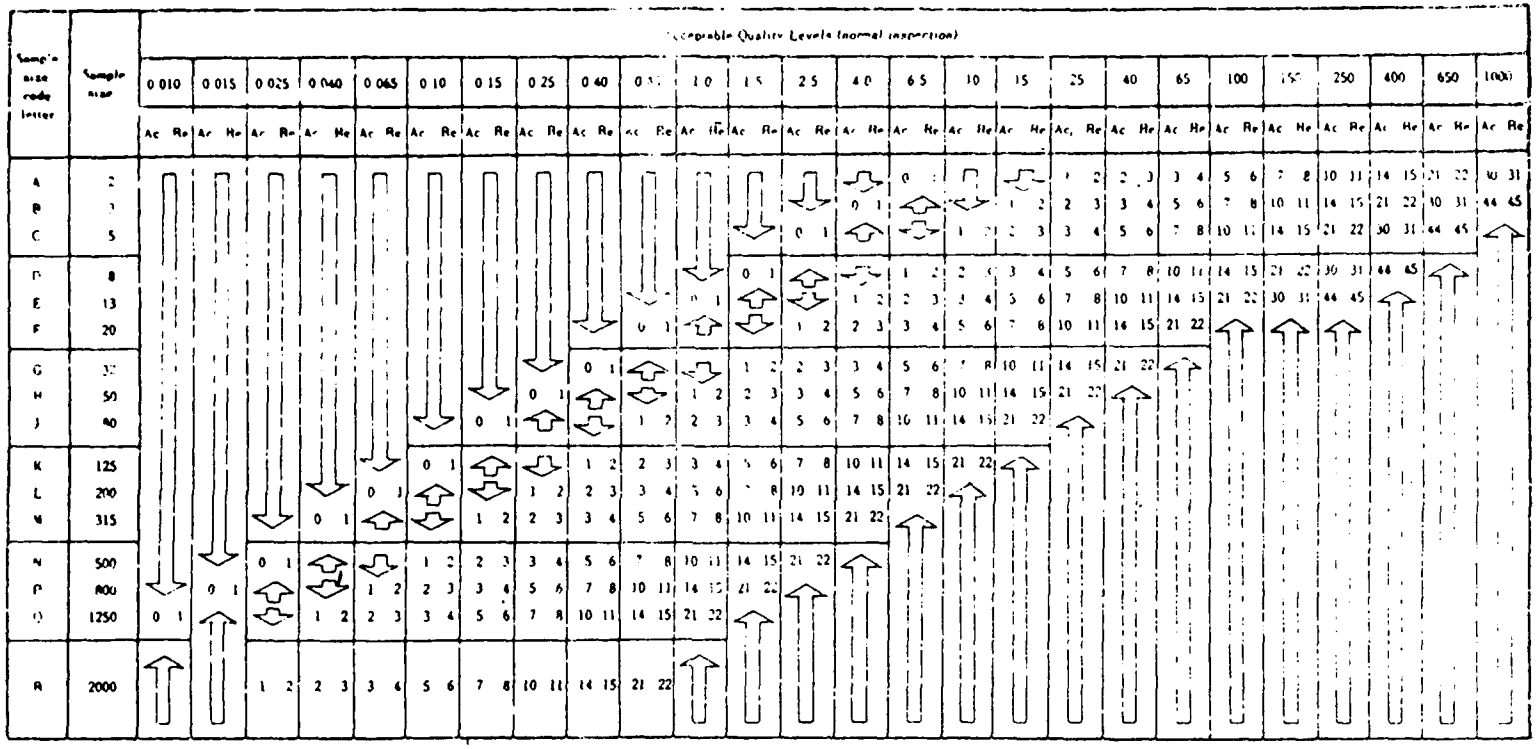
Lot or batch size			Special inspection levels				General inspection levels		
			S-1	S-2	S-3	S-4	I	II	III
2	to	8	A	A	A	A	A	A	B
9	to	15	A	A	A	A	A	B	C
16	to	25	A	A	B	B	B	C	D
26	to	50	A	B	B	C	C	D	E
51	to	90	B	B	C	C	C	E	F
91	to	150	B	B	C	D	D	F	G
151	to	280	B	C	D	E	E	G	H
281	to	500	B	C	D	E	F	H	J
501	to	1200	C	C	E	F	G	J	K
1201	to	3200	C	D	E	G	H	K	L
3201	to	10000	C	D	F	G	J	L	M
10001	to	35000	C	D	F	H	K	M	N
35001	to	150000	D	E	G	J	L	N	P
150001	to	500000	D	E	G	J	M	P	Q
500001	and	over	D	E	H	K	N	Q	R

CODE LETTER

NORMAL SINGLE

TABLE II-A — *Single sampling plans for normal inspection (Master table)*

(See 9.4 and 9.5)



⇩ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection

⇧ = Use first sampling plan above arrow.

Ac = Acceptance number

Re = Rejection number

TABLE II-E — *Single sampling plans for tightened inspection (Master table)*

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptable Quality Levels (tightened inspection)																																			
		0.010		0.01		0.025		0.040		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		25		40		65	
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re
A	2																																				
B	3																											0	1								
C	5																									0	1										
D	8																							0	1					1	2	2	3	3	4	5	6
E	13																													2	3	3	4	5	6	8	9
F	20																					0	1			1	2			3	4	5	6	8	9	12	13
G	32																			0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19
H	50																	0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19		
J	80															0	1					1	2	3	4	5	6	8	9	12	13	18	19				
K	125													0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19						
L	200											0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19								
M	315									0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19										
N	500					0	1					1	2	2	3	3	4	5	6	8	9	12	13	18	19												
P	800			0	1			1	2	2	3	3	4	5	6	8	9	12	13	18	19																
Q	1250					1	2	2	3	3	4	5	6	8	9	12	13	18	19																		
R	2000	0	1																																		
S	3150			1	2																																

⇩ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.

SINGLE
TIGHTENED

SINGLE
REDUCED

TABLE II-C—Single sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptable Quality Levels (reduced inspection)†																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	2 4	3 5	5 6	7 8	10 11	14 15	21 22	30 31
C	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑
D	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑
E	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑	↑
F	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑
G	13	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑
H	20	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑
J	32	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	50	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	80	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	125	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	200	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	315	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	500	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	800	↑	↑	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
† = If the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.4).

(for Normal Inspection, Single sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level (% DEFECTIVES)															
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10
A	2															78	
B	3														63		
C	5													45			66
D	8												31			47	60
E	13											21			32	41	50
F	20										14			22	28	34	46
G	32									8.9			14	18	23	30	37
H	50								5.8			9.1	12	15	20	25	32
J	80							3.7			5.8	7.7	9.4	13	16	20	26
K	125						2.4			3.8	5.0	6.2	8.4	11	14	18	24
L	200					1.5			2.4	3.2	3.9	5.3	6.6	8.5	11	15	
M	315				0.95			1.5	2.0	2.5	3.3	4.2	5.4	7.0	9.6		
N	500			0.60			0.95	1.3	1.6	2.1	2.6	3.4	4.4	6.1			
P	800		0.38			0.59	0.79	0.97	1.3	1.6	2.1	2.7	3.8				
Q	1250	0.24			0.38	0.50	0.62	0.84	1.1	1.4	1.8	2.4					
R	2000			0.24	0.32	0.39	0.53	0.66	0.85	1.1	1.5						

TABLE VI-B — Limiting Quality (in defects per hundred units) for which P_a = 10 Percent (for Normal Inspection, Single sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2															120			200	270	330	460	590	770	1000	1400	1900
B	3														77			130	180	220	310	390	510	670	940	1300	1800
C	5													46			78	110	130	190	240	310	400	560	770	1100	
D	8												29			49	67	84	120	150	190	250	350	480	670		
E	13											18			30	41	51	71	91	120	160	220	300	410			
F	20										12			20	27	33	46	59	77	100	140						
G	32									7.2			12	17	21	29	37	48	63	88							
H	50								4.6			7.8	11	13	19	24	31	40	56								
J	80							2.9			4.9	6.7	8.4	12	15	19	25	35									
K	125						1.8			3.1	4.3	5.4	7.4	9.4	12	16	23										
L	200					1.2			2.0	2.7	3.3	4.6	5.9	7.7	10	14											
M	315				0.73			1.2	1.7	2.1	2.9	3.7	4.9	6.4	9.0												
N	500			0.46			0.78	1.1	1.3	1.9	2.4	3.1	4.0	5.6													
P	800		0.29			0.49	0.67	0.84	1.2	1.5	1.9	2.5	3.5														
Q	1250	0.18			0.31	0.43	0.53	0.74	0.94	1.2	1.6	2.3															
R	2000			0.20	0.27	0.33	0.46	0.59	0.77	1.0	1.4																

10% (DEFECTS)

TABLE VI-A — Limiting Quality (in percent defective) for which P_a = 10 Percent (for Normal Inspection, Single sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level															
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10
A	2															68	
B	3														54		
C	5													37			58
D	8												25			41	54
E	13											16			27	36	44
F	20										11			18	25	30	42
G	32									6.9			12	16	20	27	34
H	50								4.5			7.6	10	13	18	22	29
J	80							2.8			4.8	6.5	8.2	11	14	19	24
K	125						1.8			3.1	4.3	5.4	7.4	9.4	12	16	23
L	200					1.2			2.0	2.7	3.3	4.6	5.9	7.7	10	14	
M	315				0.73			1.2	1.7	2.1	2.9	3.7	4.9	6.4	9.0		
N	500			0.46			0.78	1.1	1.3	1.9	2.4	3.1	4.0	5.6			
P	800		0.29			0.42	0.67	0.84	1.2	1.5	1.9	2.5	3.5				
Q	1250	0.18			0.31	0.43	0.53	0.74	0.94	1.2	1.6	2.3					
R	2000			0.20	0.27	0.33	0.46	0.59	0.77	1.0	1.4						

TABLE V-B — Average Outgoing Quality Limit Factors for Tightened Inspection (Single sampling)

(See 11.4)

Code letter	Sample size	Acceptable Quality Level																										
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2																			42	69	97	160	260	400	620	970
B	3															12			28	46	65	110	170	270	410	650	1100
C	5														7.4			17	27	39	63	100	160	250	390	610	
D	8													4.6			11	17	24	40	64	99	160	240	380		
E	13												2.8			6.5	11	15	24	40	61	95	150	240			
F	20											1.8			4.2	6.9	9.7	16	26	40	62						
G	32										1.2			2.6	4.3	6.1	9.9	16	25	39							
H	50									0.74			1.7	2.7	3.9	6.3	10	16	25								
J	80								0.66			1.1	1.7	2.6	4.0	6.4	9.9	16									
K	125							0.29			0.67	1.1	1.6	2.5	4.1	6.4	9.9										
L	200						0.18			0.42	0.69	0.97	1.6	2.6	6.0	6.2											
M	315					0.12			0.27	0.44	0.62	1.0	1.6	2.5	3.9												
N	500				0.074			0.17	0.27	0.39	0.63	1.0	1.6	2.5													
P	800			0.046			0.11	0.17	0.24	0.40	0.64	0.99	1.6														
Q	1250		0.029			0.067	0.11	0.16	0.25	0.41	0.64	0.99															
R	2000	0.018			0.042	0.069	0.097	0.16	0.26	0.40	0.62																
S	3150			0.027																							

Note: For the exact AOQL, the above values must be multiplied by $\left(1 - \frac{\text{Sample size}}{\text{Lot or Batch size}}\right)$ (see 11.4)

TABLE V-A — Average Outgoing Quality Limit Factors for Normal Inspection (Single sampling)

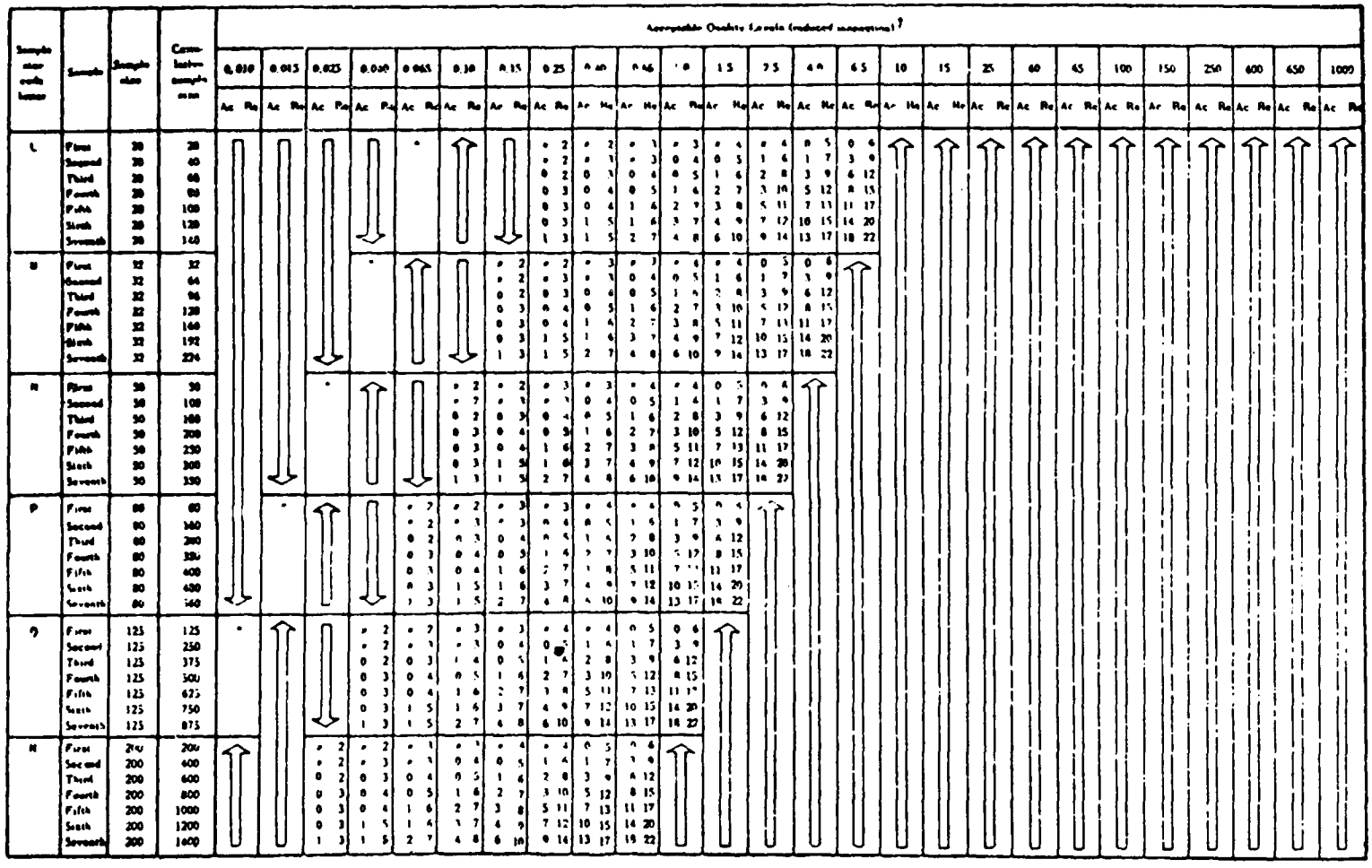
(See 11.4)

Code Letter	Sample Size	Acceptable Quality Level																								
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2															18			42	69	97	160	220	330	470	730	1100
B	3														12			28	46	65	110	150	220	310	490	720	1100
C	5													7.4			17	27	39	63	90	130	190	290	430	660	
D	8												4.6			11	17	24	40	56	82	120	180	270	410		
E	13											2.8			6.5	11	15	24	34	50	72	110	170	250			
F	20										1.8			4.2	6.9	9.7	16	22	33	47	73						
G	32									1.2			2.6	4.3	6.1	9.9	14	21	29	46							
H	50								0.74			1.7	2.7	3.9	6.3	9.0	13	19	29								
J	80							0.46			1.1	1.7	2.4	4.0	5.6	8.2	12	18									
K	125						0.29			0.67	1.1	1.6	2.5	3.6	5.2	7.5	12										
L	200					0.18			0.42	0.69	0.97	1.6	2.2	3.3	4.7	7.3											
M	315				0.12			0.27	0.44	0.62	1.00	1.4	2.1	3.0	4.7												
N	500			0.074			0.17	0.27	0.39	0.63	0.90	1.3	1.9	2.9													
P	800		0.046			0.11	0.17	0.24	0.40	0.56	0.82	1.2	1.8														
Q	1250	0.029			0.067	0.11	0.16	0.25	0.36	0.52	0.75	1.2															
R	2000			0.042	0.069	0.097	0.16	0.22	0.33	0.47	0.73																

Note: For the exact AOQL, the above values must be multiplied by $\left(1 - \frac{\text{Sample size}}{\text{Lot or Batch size}}\right)$ (see 11.4)

TABLE IV-C — Multiple sampling plans for reduced inspection (Master table) (Continued)

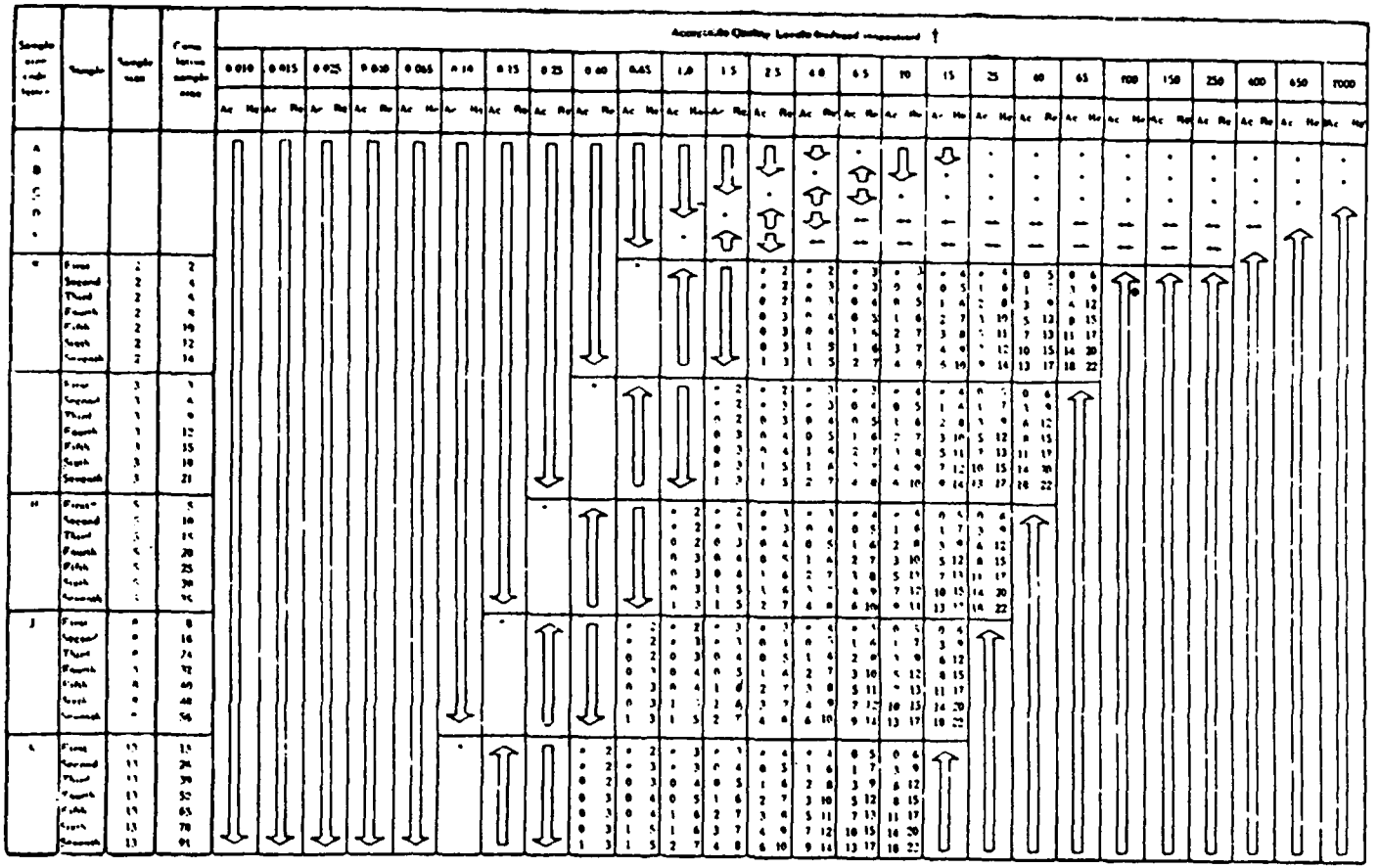
(See 9.4 and 9.5)



MULTIPLE REDUCED

TABLE IV-C — Multiple sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)



⇩ = Use first sampling plan below arrow (refer to continuation of table on following page, when necessary). If sample size equals, or exceeds lot or batch size, do 100 percent inspection.

⇧ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

• = Use corresponding single sampling plan (or alternatively, use multiple sampling plan below, where available).

— = Use corresponding double sampling plan (or alternatively, use multiple sampling plan below, where available).

* = Acceptance not permitted at this sample size.

† = If, after the final sample, the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot but reinstate normal inspection (see 10.1.6).

TABLE IV-B — Multiple sampling plans for tightened inspection (Master table) (Continued)

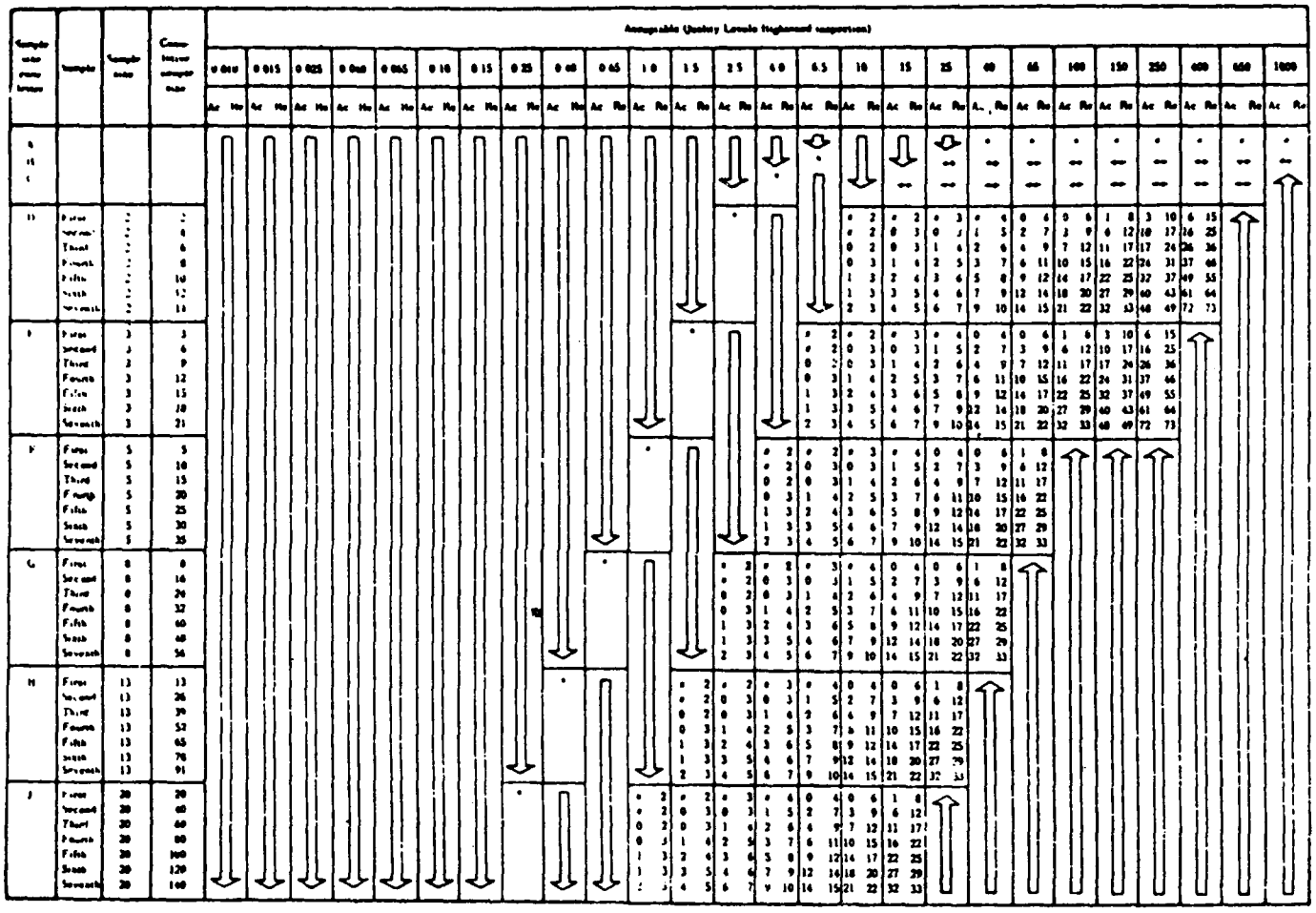
(See 9.4 and 9.5)

MULTIPLE TIGHTENED

MULTIPLE TIGHTENED

TABLE IV-B — Multiple sampling plans for tightened inspection (Master table)

(See 9.4 and 9.5)



Use first sampling plan below arrow (refer to continuation of table on following page, when necessary). If sample size equals or exceeds lot or batch size, do 100 percent inspection.

Use first sampling plan above arrow

Acceptance number

Rejection number

Use corresponding single sampling plan (or alternatively, use multiple sampling plan below, where available).

Use corresponding double sampling plan (or alternatively, use multiple sampling plan below, where available)

Acceptance not permitted at this sample size

TABLE IV-A — Multiple sampling plans for normal inspection (Master table)
(Continued)

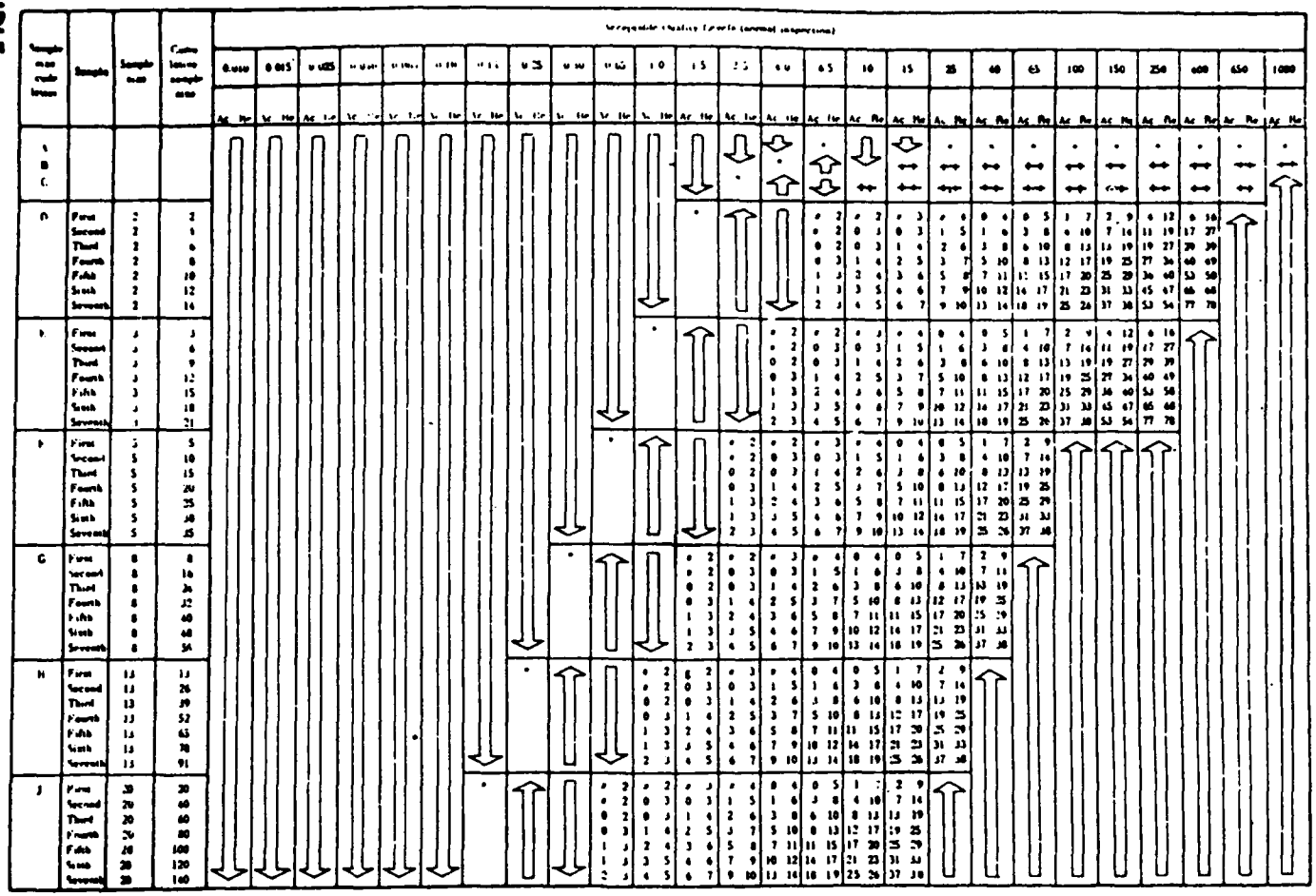
(See 9.4 and 9.5)

MULTIPLE
NORMAL

MULTIPLE
NORMAL

TABLE IV-A—Multiple sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)



Use first sampling plan below arrow (refer to continuation of table on following page, when necessary). If sample size equals or exceeds lot or batch size, do 100 percent inspection.

Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

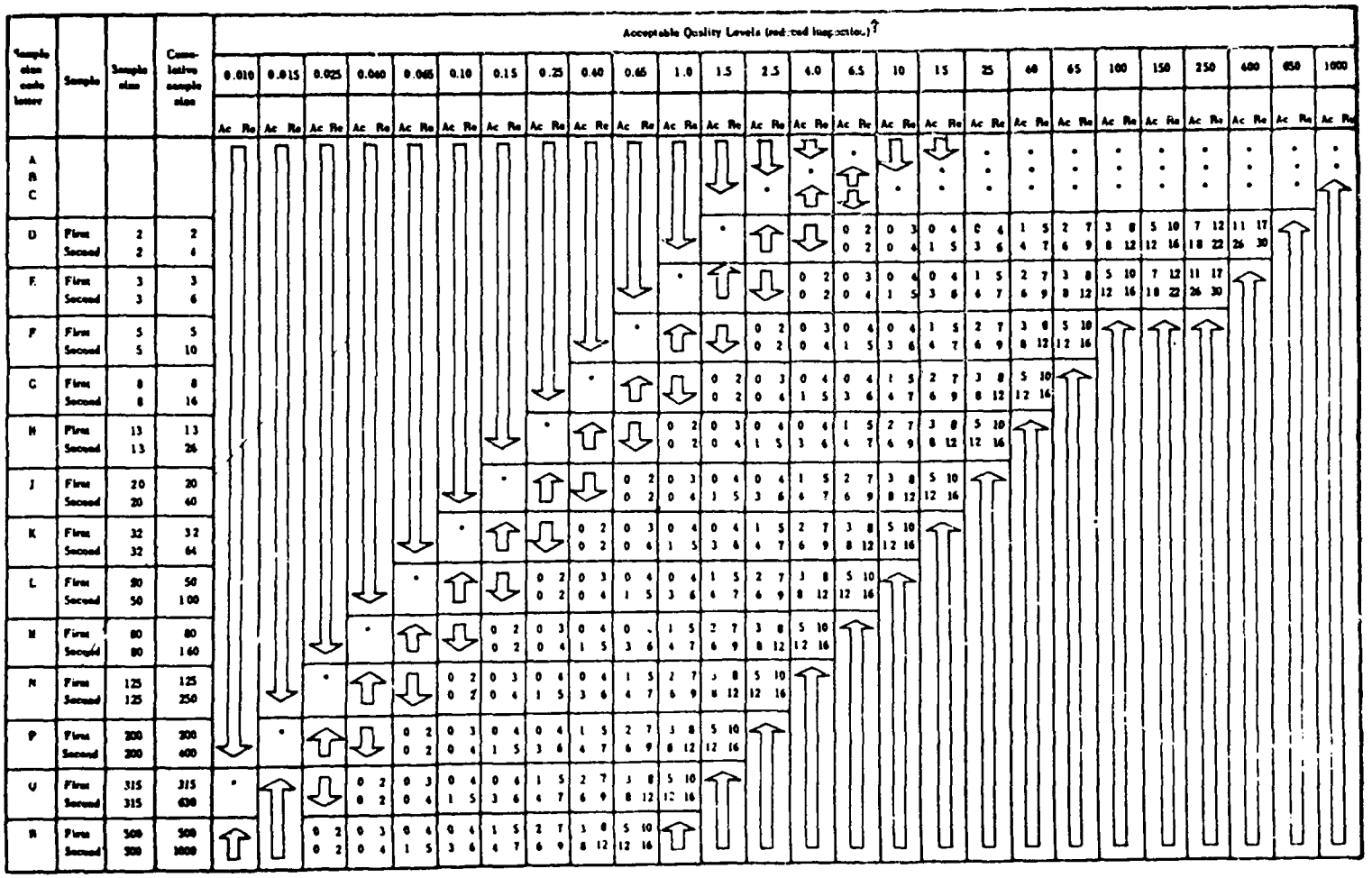
* = Use corresponding single sampling plan (or alternatively, use multiple sampling plan below, where available).

↓↑ = Use corresponding double sampling plan (or alternatively, use multiple sampling plan below, where available).

* = Acceptance not permitted at this sample size.

TABLE III-C — Double sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)



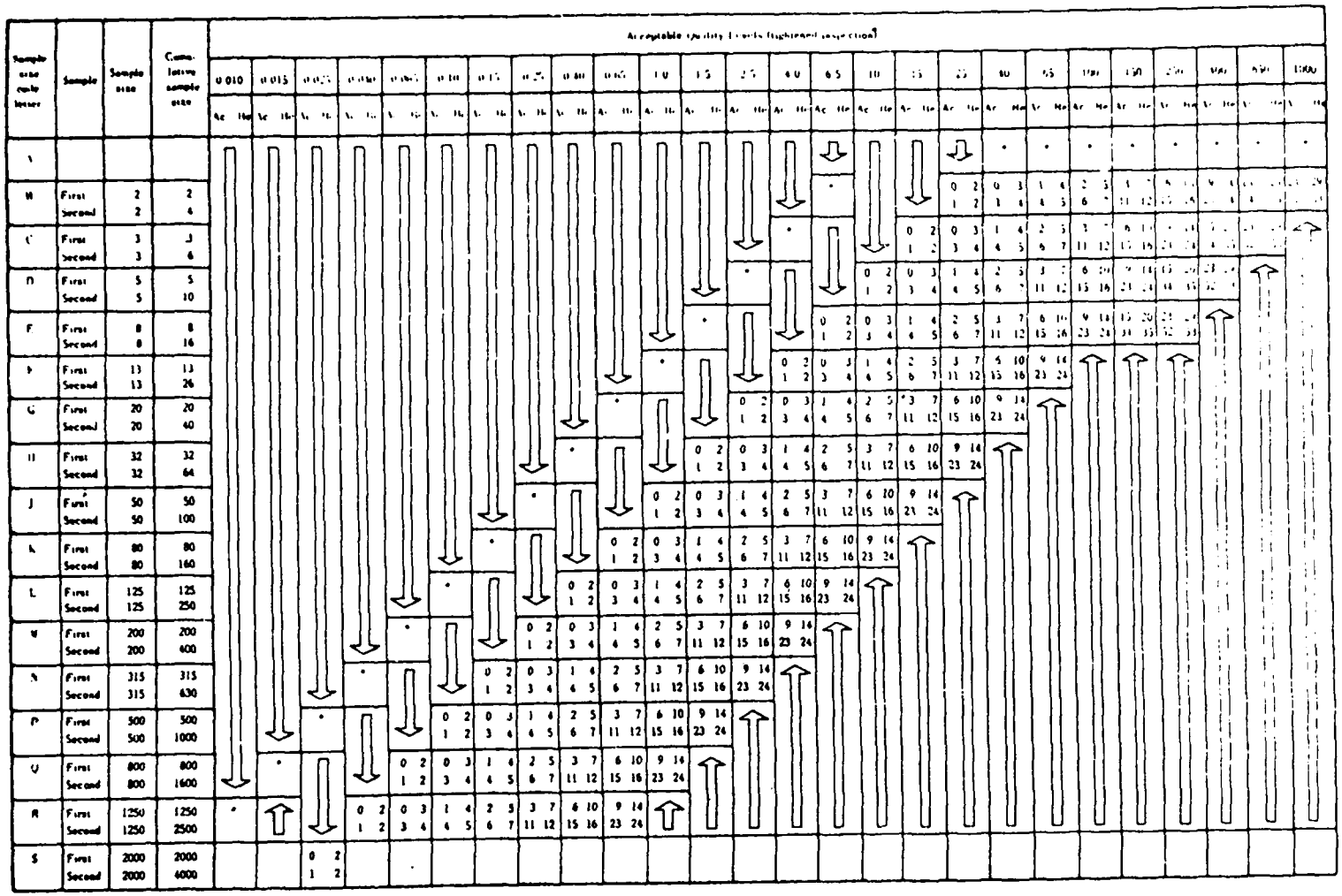
Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (reduced inspection) ↑																																			
				0.010		0.015		0.025		0.040		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		25		40		65		100		150		250		400		650		1000	
				Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re
A B C																																																		
D	First	2	2																																																
	Second	2	4																																															
F	First	3	3																																															
	Second	3	6																																															
P	First	5	5																																															
	Second	5	10																																															
G	First	8	8																																															
	Second	8	16																																															
H	First	13	13																																															
	Second	13	26																																															
J	First	20	20																																															
	Second	20	40																																															
K	First	32	32																																															
	Second	32	64																																															
L	First	50	50																																															
	Second	50	100																																															
M	First	80	80																																															
	Second	80	160																																															
N	First	125	125																																															
	Second	125	250																																															
P	First	200	200																																															
	Second	200	400																																															
Q	First	315	315																																														
	Second	315	630																																															
R	First	500	500																																															
	Second	500	1000																																														

⇩ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).
† = If, after the second sample, the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.6).

DOUBLE REDUCED

TABLE III-B — Double sampling plans for tightened inspection (Master table)

(See 9.4 and 9.5)



Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

Use first sampling plan above arrow.

Ac = Acceptance number

Re = Rejection number

* = Use corresponding single sampling plan (or, alternatively, use double sampling plan below, where available)

TABLE III-A—Double sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	*	*	*	*	*	*	*	*	*
B	First	2	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31
	Second	2	4																	1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57
C	First	3	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	↑
	Second	3	6																1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57	
D	First	5	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	↑	↑
	Second	5	10															1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57		
E	First	8	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	17 22	25 31	↑	↑	↑
	Second	8	16														1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27	37 38	56 57			
F	First	13	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑
	Second	13	26													1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27						
G	First	20	20	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑
	Second	20	40											1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27								
H	First	32	32	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑
	Second	32	64											1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27								
J	First	50	50	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	50	100									1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27										
K	First	80	80	↓	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	80	160									1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27										
L	First	125	125	↓	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	125	250								1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27											
M	First	200	200	↓	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	200	400							1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27												
N	First	315	315	↓	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	315	630						1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27													
P	First	500	500	↓	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	500	1000					1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27														
Q	First	800	800	*	↑	↓	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	800	1600				1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27															
R	First	1250	1250	↑	↑	0 2	0 3	1 4	2 5	3 7	5 9	7 11	11 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	1250	2500			1 2	3 4	4 5	6 7	8 9	12 13	18 19	26 27																

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

↑ = Use first sampling plan above arrow

Ac = Acceptance number

Re = Rejection number

* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available)

DOUBLE NORMAL

TABLE VII-B—Limiting Quality (in defects per hundred units) for which P_a = 5 Percent (for Normal Inspection, Single sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level																								
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2														100	150			240	320	390	530	660	850	1100	1500	2000
B	3																	160	210	260	350	440	570	730	1000	1400	1900
C	5													60			95	130	160	210	260	340	440	610	810	1100	
D	8												38			59	79	97	130	160	210	270	380	510	710		
E	13											23			37	48	60	81	100	130	170	230	310	440			
F	20										15			24	32	39	53	66	85	110	150						
G	32									9.4			15	20	24	33	41	53	68	95							
H	50								6.0			9.5	13	16	21	26	34	44	61								
J	80							3.8			5.9	7.9	9.7	13	16	21	27	38									
K	125						2.4			3.8	5.0	6.2	8.4	11	14	18	24										
L	200					1.5			2.4	3.2	3.9	5.3	6.6	8.5	11	15											
M	315				0.95			1.5	2.0	2.5	3.3	4.2	5.4	7.0	9.6												
N	500			0.60			0.95	1.3	1.6	2.1	2.6	3.4	4.4	6.1													
P	800		0.38			0.59	0.79	0.97	1.3	1.6	2.1	2.7	3.8														
Q	1250	0.24			0.38	0.50	0.62	0.84	1.1	1.4	1.8	2.4															
R	2000			0.24	0.32	0.39	0.53	0.66	0.8	1.1	1.5																

10 (DEFECTS)
5%

LIMIT NUMBERS

TABLE VIII — Limit Numbers for Reduced Inspection

(See 8.3.3)

Number of sample units from last 10 lots or batches	Acceptable Quality Level																								
	0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
20 - 29	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	8	14	22	40	69	115	181
30 - 49	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	1	3	7	13	22	36	63	105	178	277
50 - 79	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	3	7	14	25	40	63	110	181	301	
80 - 129	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	7	14	24	42	68	105	181	297		
130 - 199	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	7	13	25	42	72	115	177	301	490		
200 - 319	*	*	*	*	*	*	*	*	*	*	0	0	2	4	8	14	22	40	68	115	181	277	471			
320 - 499	*	*	*	*	*	*	*	*	*	0	0	1	4	8	14	24	39	68	113	189						
500 - 799	*	*	*	*	*	*	*	*	0	0	2	3	7	14	25	40	63	110	181							
800 - 1249	*	*	*	*	*	*	*	0	0	2	4	7	14	24	42	68	105	181								
1250 - 1999	*	*	*	*	*	*	0	0	2	4	7	13	24	40	69	110	169									
2000 - 3149	*	*	*	*	*	0	0	2	4	8	14	22	40	68	115	181										
3150 - 4999	*	*	*	*	0	0	1	4	8	14	24	38	67	111	186											
5000 - 7999	*	*	*	0	0	2	3	7	14	25	40	63	110	181												
8000 - 12499	*	*	0	0	2	4	7	14	24	42	68	105	181													
12500 - 19999	*	0	0	2	4	7	13	24	40	69	110	169														
20000 - 31499	0	0	2	4	8	14	22	40	68	115	181															
31500 - 49999	0	1	4	8	14	24	38	67	111	186																
50000 & Over	2	3	7	14	25	40	63	110	181	301																

* Denotes that the number of sample units from the last ten lots or batches is not sufficient for reduced inspection for this AQL. In this instance more than ten lots or batches may be used for the calculation, provided that the lots or batches used are the most recent ones in sequence, that they have all been on normal inspection, and that none has been rejected while on original inspection.

TABLE IX — Average sample size curves for double and multiple sampling
(normal and tightened inspection)

(See 11.5)

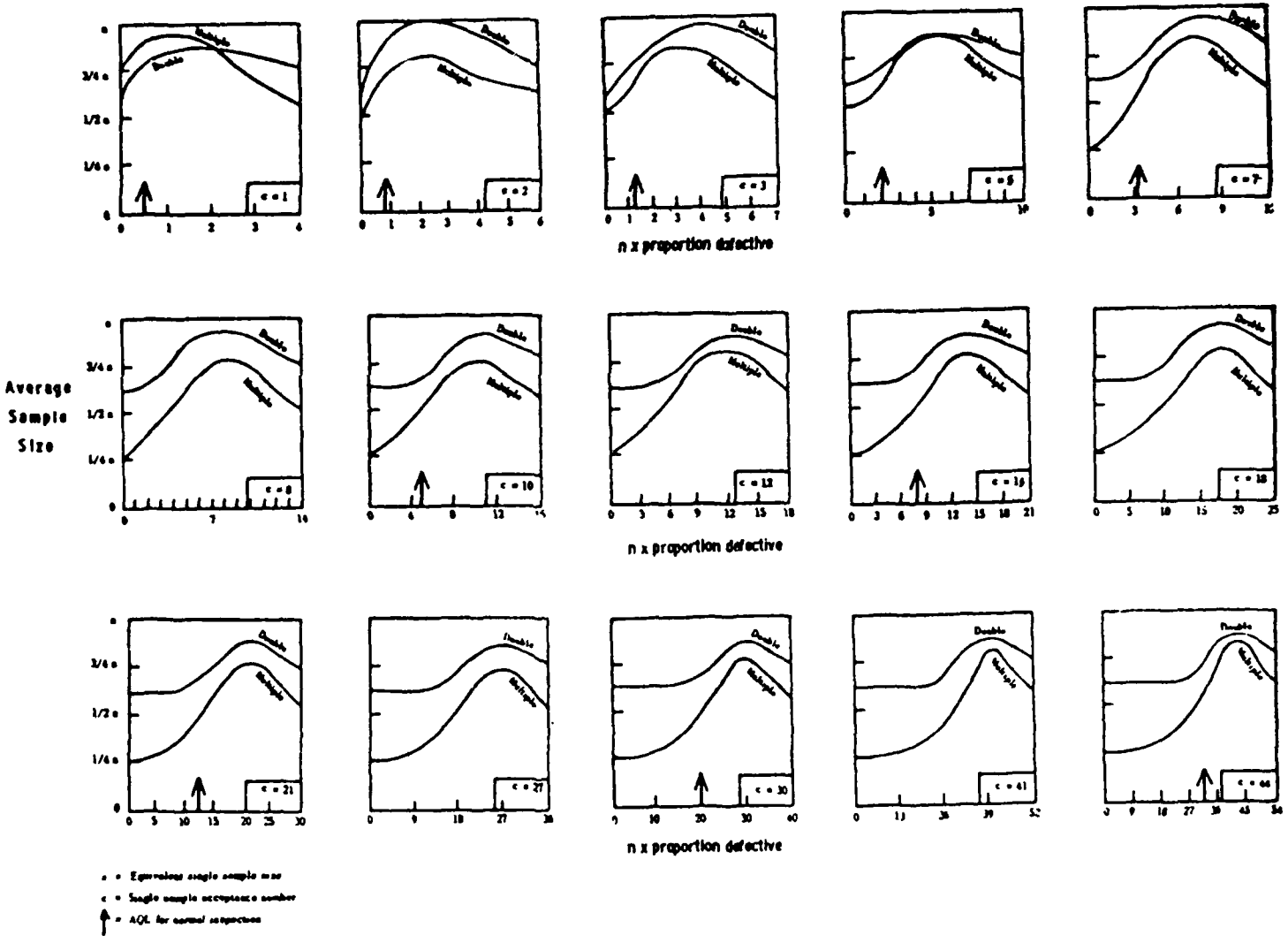
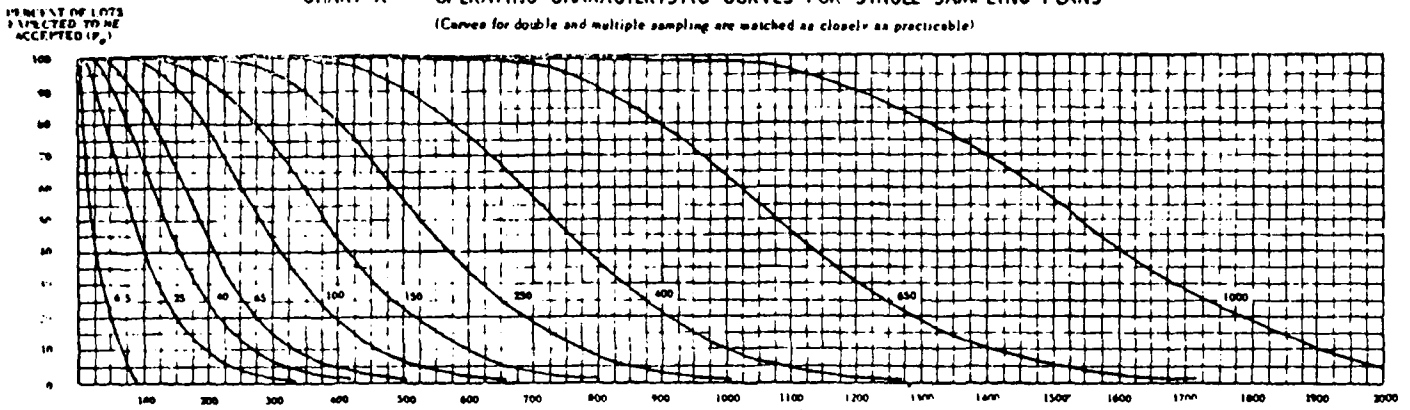


TABLE X-A---Tables for sample size code letter: A

CHART A - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's $\leq$ 10, in defects per hundred units for AQL's $>$ 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-A-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)														
	6.5	0.5	25	40	65	100	150	X	250	X	400	X	650	X	1000
	p (in percent defective)	p (in defects per hundred units)													
99.0	0.501	0.51	7.45	21.8	41.2	89.2	145	175	239	305	374	517	629	859	977
95.0	2.53	2.56	17.8	40.9	68.3	131	199	235	308	385	462	622	745	995	1122
90.0	5.13	5.25	26.6	55.1	87.3	158	233	272	351	432	515	684	812	1073	1206
75.0	13.4	14.4	48.1	86.8	127	211	298	342	431	521	612	795	934	1214	1354
50.0	29.3	34.7	83.9	134	184	284	383	433	533	633	733	933	1083	1383	1533
25.0	50.0	69.3	135	196	256	371	484	540	651	761	870	1087	1248	1568	1728
10.0	68.4	115	195	266	334	464	589	650	770	889	1006	1238	1409	1748	1916
5.0	77.6	150	237	315	388	526	657	722	848	972	1094	1334	1512	1862	2035
1.0	90.0	230	332	420	502	655	800	870	1007	1141	1272	1529	1718	2088	2279
	X	X	40	65	100	150	X	250	X	400	X	650	X	1000	X
	Acceptable Quality Levels (tightened inspection)														

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-A-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: A

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																				Cumulative sample size
		Less than 6.5		6.5			10	15	25	40	65	100	150		250		400		650		1000	
		Ac	Re	Ac	Re		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re		Ac Re		Ac Re		Ac Re		Ac Re	
Single	2	▽		0	1		Use Letter D	Use Letter C	Use Letter B	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	2
Double		▽		•						(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	
Multiple		▽								•	•	•	•	•	•	•	•	•	•	•	•	
		Less than 10					10	15	25	40	65	100	150		250		400		650		1000	
		Acceptable Quality Levels (tightened inspection)																				

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

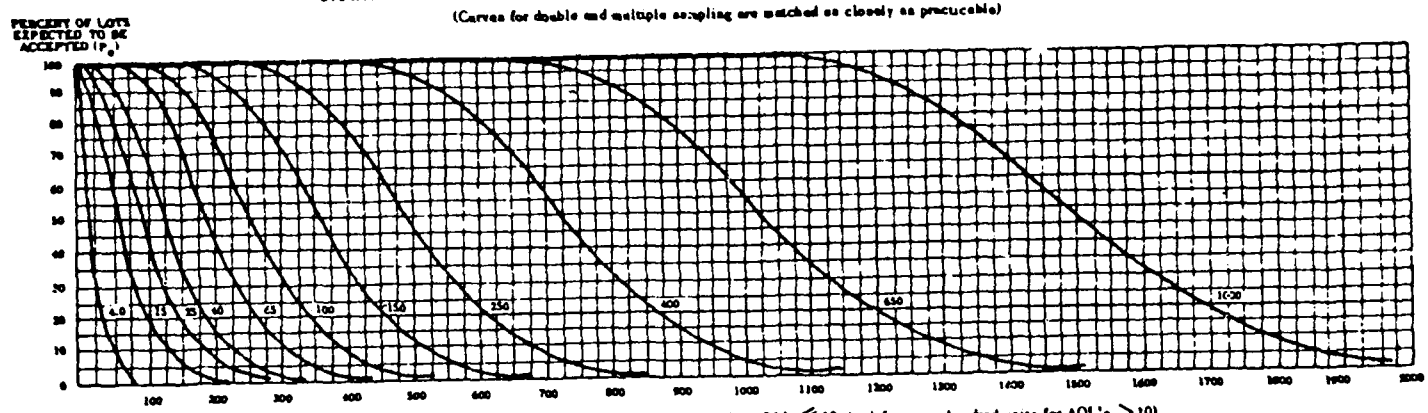
Re = Rejection number

• = Use single sampling plan above (or alternatively use letter D)

(*) = Use single sampling (or alternatively use letter B)

CHART B - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's $\leq$ 10; in defects per hundred units for AQL's $>$ 10)

Notes: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection.

TABLE X-B-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)															
	4.0	4.0	15	25	40	65	100	X	150	X	250	X	400	X	650	X	1000
	p (in percent defective)	p (in defects per hundred units)															
99.0	0.33	0.34	6.97	14.5	27.4	59.5	96.9	117	159	203	249	345	419	573	651	947	1029
95.0	1.70	1.71	11.8	27.3	45.5	87.1	133	157	206	256	308	415	496	663	748	1065	1152
90.0	3.45	3.50	17.7	36.7	58.2	105	155	181	234	288	343	456	541	716	804	1131	1222
75.0	9.16	9.60	32.0	57.6	84.5	141	199	228	287	347	408	530	623	809	903	1249	1344
50.0	20.6	23.1	55.9	89.1	122	189	256	289	356	422	489	622	722	922	1022	1389	1489
25.0	37.0	46.2	89.8	131	170	247	323	360	434	507	580	724	832	1046	1152	1539	1644
10.0	53.6	76.8	130	177	223	309	392	433	514	593	671	825	939	1165	1277	1683	1793
5.0	63.2	99.9	158	210	258	350	438	481	565	648	730	890	1008	1241	1356	1773	1886
1.0	78.4	154	221	280	335	437	533	580	672	761	848	1019	1145	1392	1513	1951	2069
	6.5	6.5	25	40	65	100	X	150	X	250	X	400	X	650	X	1000	X
	Acceptable Quality Levels (tightened inspection)																

Notes: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-B-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: B

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																														Cumulative sample size
		Less than 4.0		4.0		6.5			10		15		25		40		65		100			150			250			400			650			1000		
		Ac	Re	Ac	Re	Ac	Re		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re		Ac	Re		Ac	Re		Ac	Re		Ac	Re		Ac	Re	
Single	3	▽		0	1						1	2	2	3	3	4	5	6	7	8		8	9		10	11		12	13		14	15		18	19		21	22		27	28		30	31		41	42		44	45		3
Double	2	▽		•		Use Letter A			Use Letter D		0	2	0	3	1	4	2	5	3	7		3	7		5	9		6	10		7	11		9	14		11	16		15	20		17	22		23	29		25	31		2
	4										1	2	3	4	4	5	6	7	8	9		11	12		12	13		15	16		18	19		23	24		26	27		34	35		37	38		52	53		56	57		4
Multiple		▽		•							↔		↔		↔		↔		↔			↔			↔			↔			↔			↔			↔			↔			↔			↔			↔		
		Less than 6.5		6.5					10		15		25		40		65		100			150			250			400			650			1000		
		Acceptable Quality Levels (tightened inspection)																																		

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

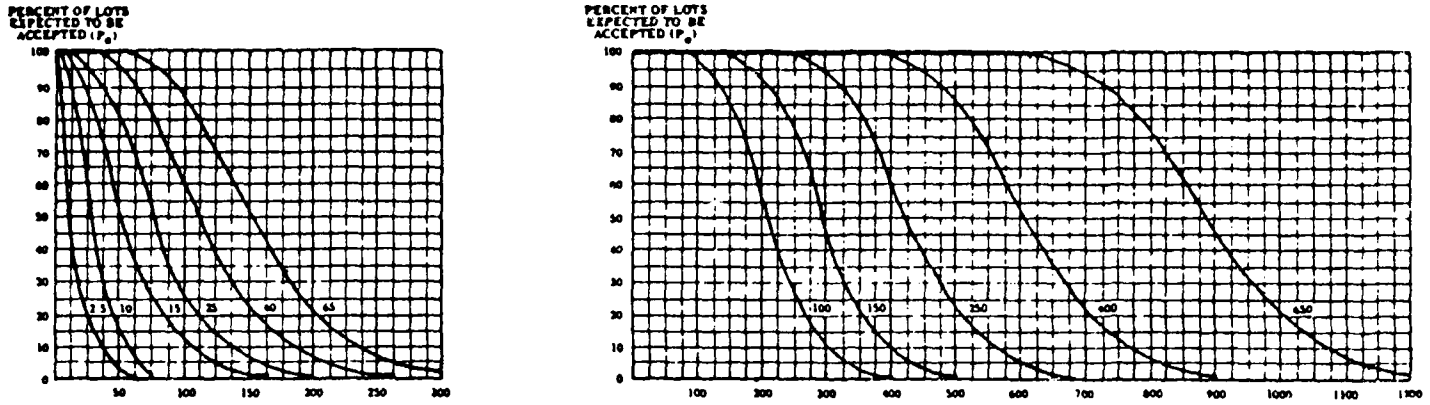
Re = Rejection number

• = Use single sampling plan above (or alternatively use letter E).

↔ = Use double sampling plan above (or alternatively use letter D).

CHART C - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10, in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-C-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																	
	2.5	10	2.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650
	p (in percent defective)		p (in defects per hundred units)															
99.0	0.20	3.28	0.20	2.89	8.72	16.5	35.7	58.1	70.1	95.4	122	150	207	251	344	391	568	618
95.0	1.02	7.63	1.03	7.10	16.4	27.3	52.3	79.6	93.9	123	154	185	249	298	398	449	639	691
90.0	2.09	11.2	2.10	10.6	22.0	34.9	63.0	93.1	109	140	173	206	273	325	429	482	679	733
75.0	5.59	19.4	5.76	19.2	34.5	50.7	84.4	119	137	172	208	245	318	374	485	542	749	806
50.0	12.9	31.4	13.9	33.6	53.5	73.4	113	153	173	213	253	293	373	433	553	613	833	893
25.0	24.2	45.4	27.7	53.9	78.4	102	148	194	216	260	304	348	435	499	627	691	923	987
10.0	36.9	58.4	46.1	77.8	106	134	186	235	260	308	356	403	495	564	699	766	1010	1076
5.0	45.1	65.8	59.9	94.9	126	155	210	263	289	339	389	438	534	605	745	814	1064	1131
1.0	60.2	77.8	92.1	133	168	201	262	320	348	403	456	509	612	687	835	908	1171	1241
	4.0	X	4.0	15	25	40	65	X	100	X	150	X	250	X	400	X	650	X
	Acceptable Quality Levels (tightened inspection)																	

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-C-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: C

Type of sampling plan	Cumulative sample size	Less than 2.5	2.5	4.0	X	6.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650	1000	Cumulative sample size
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	5	▽	0 1	Use Letter B	Use Letter E	Use Letter D	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	41 42	44 45	Use Letter B	5
Double	3 6	▽	•				0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	3 7 11 12	5 9 12 13	6 10 15 16	7 11 18 19	9 14 23 24	11 16 26 27	15 20 34 35	17 22 37 38	23 29 52 53	25 31 56 57		3 6
Multiple		▽	•				↠	↠	↠	↠	↠	↠	↠	↠	↠	↠	↠	↠	↠	↠	↠		
		Less than 4.0	4.0	X	6.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650	X	1000	

Acceptable Quality Levels (tightened inspection)

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

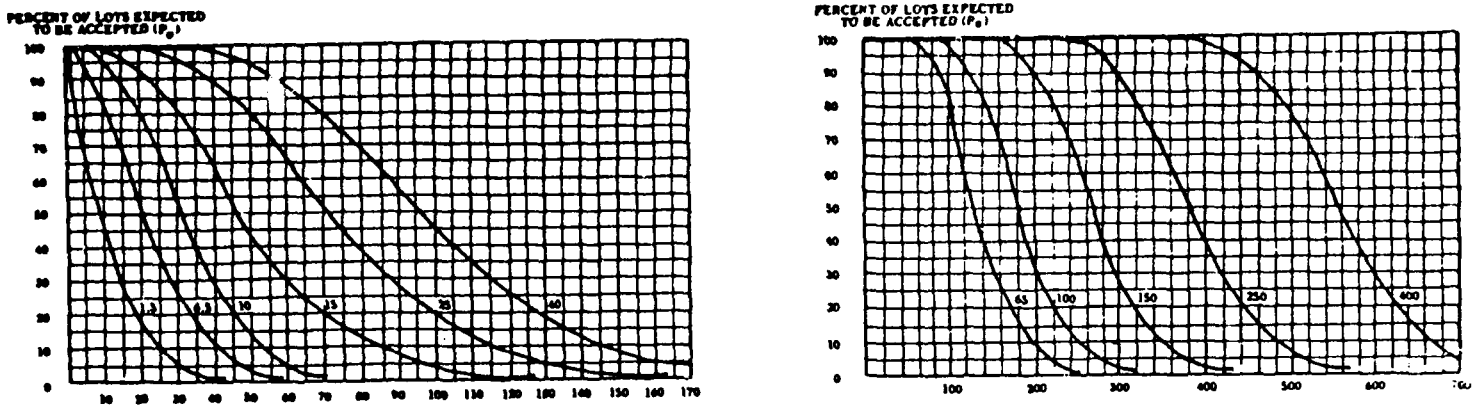
Re = Rejection number.

• = Use single sampling plan above (or alternatively use letter F).

↠ = Use double sampling plan above (or alternatively use letter D).

CHART D - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's $\leq$ 10; in defects per hundred units for AQL's $>$ 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection.

TABLE X-D-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																		
	1.5	6.5	10	1.5	6.5	10	15	25	40	X	65	X	100	X	150	X	250	X	400
	p (in percent defective)			p (in defects per hundred units)															
99.0	0.13	2.00	6.00	0.13	1.86	5.45	10.3	22.3	36.3	43.8	59.6	76.2	93.5	129	157	215	244	355	396
95.0	0.64	2.64	11.1	0.64	4.44	10.2	17.1	32.7	49.8	58.7	77.1	96.1	116	156	186	249	281	399	432
90.0	1.31	6.88	14.7	1.31	6.65	13.8	21.8	39.4	58.2	67.9	87.8	108	129	171	203	268	301	424	458
75.0	3.53	12.1	22.1	3.60	12.0	21.6	31.7	52.7	74.5	85.5	108	130	153	199	234	303	339	468	504
50.0	8.30	20.1	32.1	8.66	21.0	33.6	45.9	70.9	95.9	108	133	158	183	233	271	346	383	521	558
25.0	15.9	30.3	43.3	17.3	33.7	49.0	63.9	92.8	121	135	163	190	218	272	312	392	432	577	617
10.0	25.0	40.6	53.9	28.8	48.6	66.5	83.5	116	147	162	193	222	252	309	352	437	478	631	672
5.0	31.2	47.1	59.9	37.5	59.3	78.7	96.9	131	164	180	212	243	274	334	378	465	509	665	707
1.0	43.8	58.8	70.7	57.6	83.0	105	126	164	200	218	252	285	318	382	429	522	568	732	776
	2.5	10	X	2.5	10	15	25	40	X	65	X	100	X	150	X	250	X	400	X
	Acceptable Quality Levels (tightened inspection)																		

TABLE X-D-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: D

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																																		Cumulative sample size
		Less than 1.5		1.5		2.5				4.0		6.5		10		15		25		40				65				100				150				250				400		Higher than 400		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	8	▽		0	1	Use Letter C		Use Letter F		Use Letter E		↓	↓	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	27	28	30	31	41	42	44	45	△		8
Double	5	▽		•								↓	↓	0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	15	20	17	22	23	29	25	31	△		5
	10											↓	↓	1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27	34	35	37	38	52	53	56	57			10
Multiple	2	▽		•								↓	↓	#	2	#	2	#	3	#	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	3	10	4	12	6	15	6	16	△		2
	4											↓	↓	#	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14	10	17	11	19	16	25	17	27			4
	6											↓	↓	0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19	17	24	19	27	26	36	29	39			6
	8											↓	↓	0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25	24	31	27	34	37	46	40	49			8
	10											↓	↓	1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29	32	37	36	40	49	55	53	58			10
	12											↓	↓	1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33	40	43	45	47	61	64	65	68			12
	14											↓	↓	2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38	48	49	53	54	72	73	77	78			14
		Less than 2.5		2.5				4.0		6.5		10		15		25		40				65				100				150				250				400		Higher than 400		
		Acceptable Quality Levels (tightened inspection)																																							

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

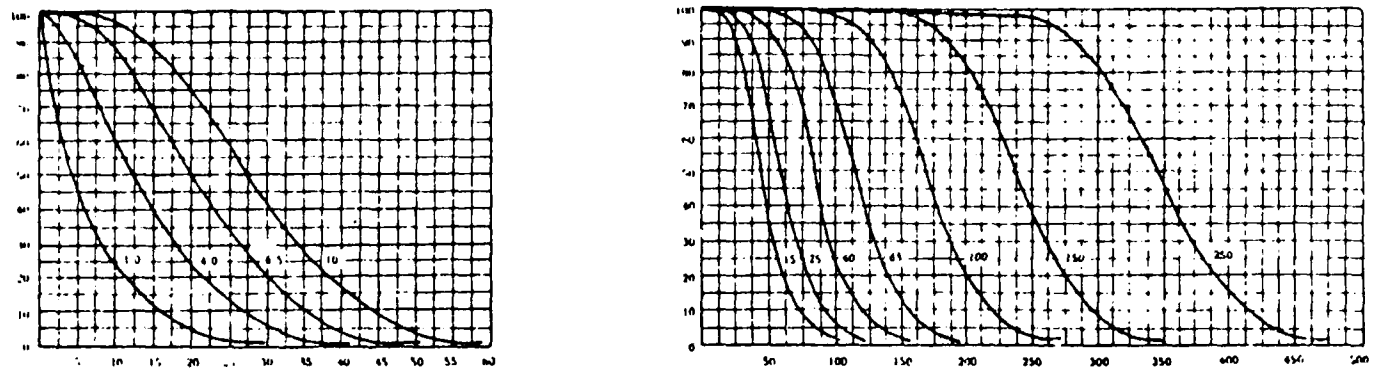
Re = Rejection number

• = Use single sampling plan above (or alternatively use letter G).

= Acceptance not permitted at this sample size.

CHART E - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS p_t, in percent defective for AQL's $\leq$ 10, in defects per hundred units for AQL's $>$ 10

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-E-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																		
	1.0	4.0	6.5	10	1.0	4.0	6.5	10	15	25	X	40	X	65	X	100	X	150	X	250
	p (in percent defective)				p (in defects per hundred units)														
99.0	0.077	1.19	3.63	7.00	0.078	1.15	3.35	6.91	13.7	22.4	27.0	36.7	46.9	57.5	79.6	96.7	132	150	219	246
95.0	0.194	2.81	6.63	11.3	0.195	2.71	6.29	10.5	20.1	30.6	36.1	47.5	59.2	71.1	95.7	115	153	175	236	266
90.0	0.807	4.16	8.80	14.2	0.808	4.09	8.48	13.4	24.2	35.8	41.8	54.0	66.5	79.2	105	125	165	185	261	282
75.0	2.19	7.41	13.8	19.9	2.22	7.39	13.3	19.5	32.5	45.8	52.6	66.3	80.2	94.1	122	144	187	208	288	310
50.0	5.19	12.6	20.0	27.5	5.33	12.9	20.6	28.2	43.6	59.0	66.7	82.1	97.5	113	144	168	213	236	321	344
25.0	10.1	19.4	28.0	36.2	10.7	20.7	30.2	39.3	57.1	74.5	83.1	100	117	134	167	192	241	266	355	379
10.0	16.2	26.8	36.0	44.4	17.7	29.9	40.9	51.4	71.3	90.5	100	119	137	155	190	217	269	295	388	414
5.0	20.6	31.6	41.0	49.5	23.0	36.5	48.4	59.6	80.9	101	111	130	150	168	205	233	286	313	409	435
1.0	29.8	41.5	50.6	58.7	35.4	51.1	64.7	77.3	101	123	134	155	176	196	235	264	321	349	450	477
	1.5	6.5	10	X	1.5	6.5	10	15	25	X	40	X	65	X	100	X	150	X	250	X
	Acceptable Quality Levels (tightened inspection)																		

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-E-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: E

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																																		Cumulative sample size
		Less than 1.0		1.0		1.5		2.5		4.0		6.5		10		15		25		40		65		100		150		250		Higher than 250								
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	13	▽		0	1					1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	27	28	30	31	41	42	44	45	△		13
Double	8	▽				Use Letter D		Use Letter G		0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	15	20	17	22	23	29	25	31	△		8
	16			•						1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27	34	35	37	38	52	53	56	57			16
Multiple	3	▽		•				Use Letter F		*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	3	10	4	12	6	15	6	16	△		3
	6									*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14	10	17	11	19	16	25	17	27			6
	9									0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19	17	24	19	27	26	36	29	39			9
	12									0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25	24	31	27	34	37	46	40	49			12
	15									1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29	32	37	36	40	49	55	53	58			15
	18									1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33	40	43	45	47	61	64	65	68			18
	21									2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38	48	49	53	54	72	73	77	78			21
		Less than 1.5		1.5				2.5		4.0		6.5		10		15		25		40		65		100		150		250		Higher than 250								
		Acceptable Quality Levels (tightened inspection)																																		

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

= Use single sampling plan above (or alternatively use letter H).

* = Acceptance not permitted at this sample size.

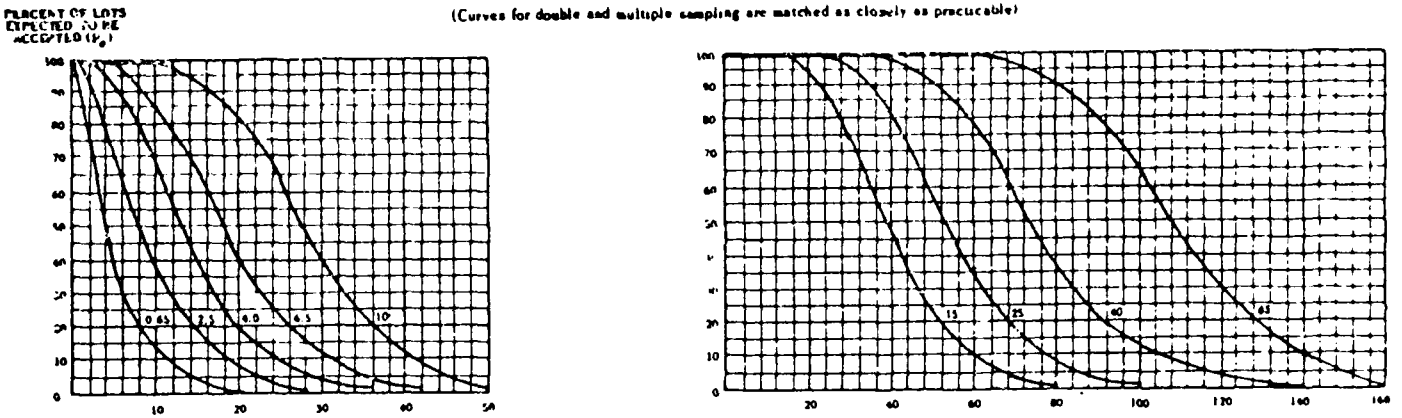


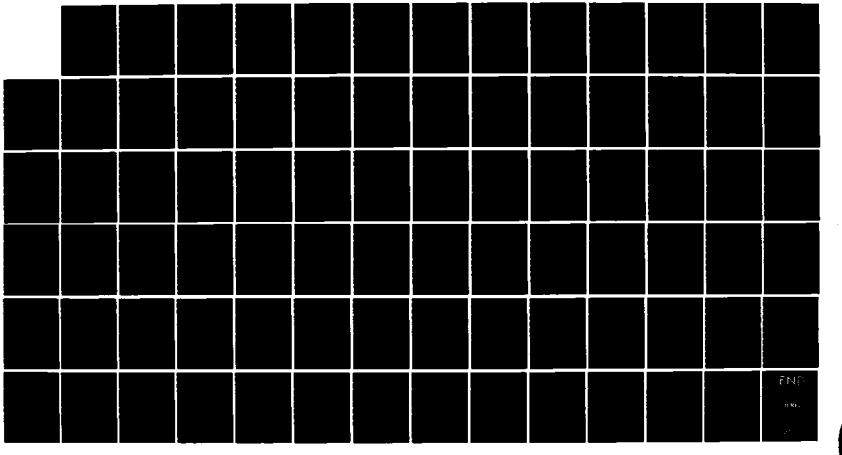
TABLE X-F-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)															
	0.65	2.5	4.0	6.5	10	0.65	2.5	4.0	6.5	10	15	X	25	X	40	X	65
	p (in percent defective)					p (in defects per hundred units)											
99.0	0.050	0.75	2.25	4.31	9.75	0.051	0.75	2.18	4.12	8.92	14.5	17.5	23.9	30.5	37.4	51.7	62.9
95.0	0.256	1.80	4.22	7.13	14.0	0.257	1.78	4.09	6.83	13.1	19.9	23.5	30.8	38.5	46.2	62.2	74.5
90.0	0.525	2.69	5.64	9.03	16.6	0.527	2.66	5.51	8.73	15.8	23.3	27.2	35.1	43.2	51.5	68.4	81.2
75.0	1.43	4.81	8.70	12.8	21.6	1.44	4.81	8.68	12.7	21.1	29.8	34.2	43.1	52.1	61.2	79.5	93.4
50.0	3.41	8.25	13.1	18.1	27.9	3.47	8.39	13.4	18.4	28.4	38.3	43.3	53.3	63.3	73.3	93.3	108
25.0	6.70	12.9	18.7	24.2	34.8	6.93	13.5	19.6	25.5	37.1	48.4	54.0	65.1	76.1	87.0	109	125
10.0	10.9	18.1	24.5	30.4	41.5	11.5	19.5	26.6	33.4	46.4	58.9	65.0	77.0	88.9	101	124	141
5.0	13.9	21.6	28.3	34.4	45.6	15.0	23.7	31.5	38.8	52.6	65.7	72.2	84.8	97.2	109	133	151
1.0	20.6	28.9	35.6	42.0	53.4	23.0	33.2	42.0	50.2	65.5	80.0	87.0	101	114	127	153	172
	1.0	4.0	6.5	10	X	1.0	4.0	6.5	10	15	X	25	X	40	X	65	X
	Acceptable Quality Levels (tightened inspection)																

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

AD-A154 767 AN AUTOMATED QUALITY ASSURANCE SURVEILLANCE PLAN FOR ADP (AUTOMATED DATA..(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA H E MORTON DEC 84 2/2

UNCLASSIFIED F/G 9/2 NL



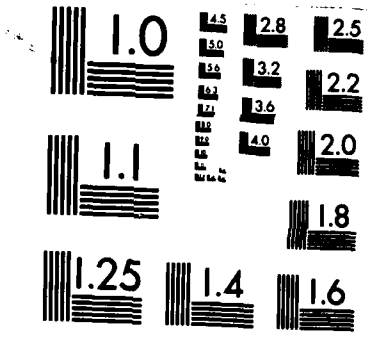


TABLE X-F-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: F

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																														Cumulative sample size
		Less than 0.65		0.65		1.0		X		1.5		2.5		4.0		6.5		10		15		X		25		X		40		X		65		Higher than 65		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	20	▽		0	1	Use Letter E		Use Letter H		Use Letter G		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		20
Double	13	▽		•								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		13
	26											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			26
Multiple	5	▽		•								*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		5
	10											*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			10
	15											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			15
	20											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			20
	25											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			25
	30											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			30
	35											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			35
		Less than 1.0		1.0		X		1.5		2.5		4.0		6.5		10		15		X		25		X		40		X		65		X		Higher than 65		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance an . rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

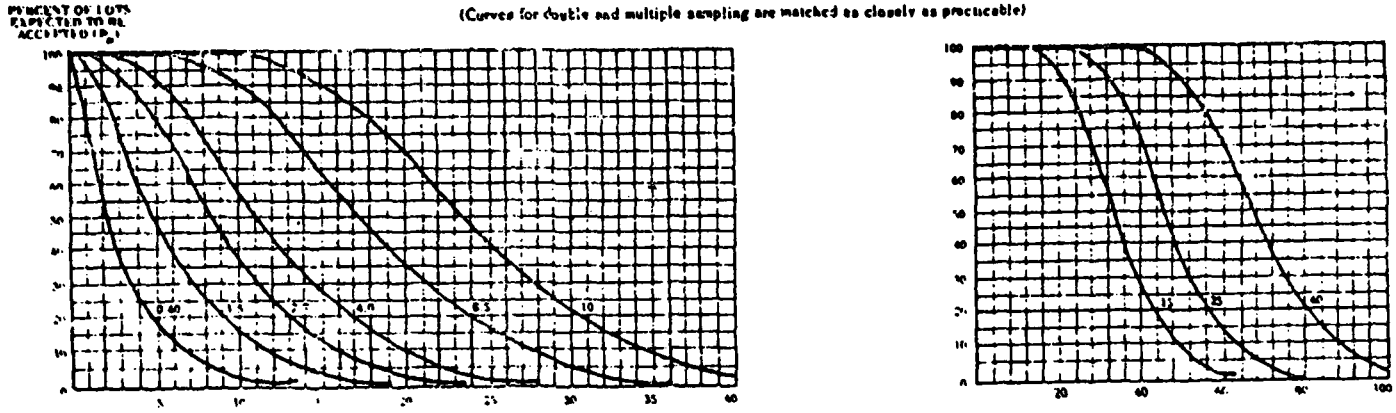
• = Use single sampling plan above (or alternatively use letter J).

* = Acceptance not permitted at this sample size.

TABLE X-G—Tables for sample size code letter: G

CHART G - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p_t) — in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-G-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																	
	0.40	1.5	2.5	4.0	6.5	10	0.40	1.5	2.5	4.0	6.5	10	X	15	X	25	X	40
	p (in percent defective)						p (in defects per hundred units)											
99.0	0.032	0.477	1.08	2.63	5.94	9.75	0.032	0.466	1.36	2.57	5.57	9.08	11.0	14.9	19.1	23.4	32.3	39.3
95.0	0.161	1.13	2.50	4.49	8.50	13.1	0.160	1.10	2.55	4.26	8.16	12.4	14.7	19.3	24.0	28.9	38.9	46.5
90.0	0.329	1.67	3.50	5.56	10.2	15.1	0.328	1.66	3.44	5.45	9.85	14.6	17.0	21.9	27.0	32.2	42.7	50.8
75.0	0.893	3.01	5.42	7.98	13.4	19.0	0.900	3.00	5.39	7.92	13.2	18.6	21.4	26.9	32.6	38.2	49.7	58.4
50.0	2.14	5.19	8.27	11.4	17.5	23.7	2.16	5.24	8.35	11.5	17.7	24.0	27.1	33.4	39.6	45.8	58.3	67.7
25.0	4.23	8.19	11.9	15.4	22.3	29.0	4.33	8.41	12.3	16.0	23.2	30.3	33.8	40.7	47.6	54.4	67.9	78.0
10.0	6.91	11.6	15.8	19.7	27.1	34.1	7.19	12.2	16.6	20.9	29.0	36.8	40.6	48.1	55.6	62.9	77.4	88.1
5.0	8.96	14.0	18.4	22.5	30.1	37.2	9.36	14.8	19.7	24.2	32.9	41.1	45.1	53.0	60.8	68.4	83.4	94.5
1.0	13.5	19.0	23.7	28.0	35.9	43.3	14.4	20.7	26.3	31.4	41.0	50.0	54.4	63.0	71.3	79.5	95.6	107
	0.65	2.5	4.0	6.5	10	X	0.65	2.5	4.0	6.5	10	X	15	X	25	X	40	X
	Acceptable Quality Levels (tightened inspection)																	

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-G-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: G

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																								Cumulative sample size
		Less than 0.40		0.40		0.65	X		1.0		1.5		2.5		4.0		6.5		10	X	15	X	25	X	40		Higher than 40	
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	32	▽		0	1	Use Letter F		Use Letter J		Use Letter H	1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△	32
Double	20	▽		•							0	2	0	3	1	4	2	5	3	7	3	7	5	9		10	7	11	9	14	11	16	△	20
	40										1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27		40
Multiple	8	▽		•							▫	2	▫	2	▫	3	▫	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△	8
	16										▫	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14		16
	24										0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19		24
	32										0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25		32
	40										1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29		40
	48										1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33		48
	56										2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38		56
		Less than 0.65		0.65		X		1.0		1.5	2.5		4.0		6.5		10		X		15	X		25	X		40	X		Higher than 40			
		Acceptable Quality Levels (tightened inspection)																															

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

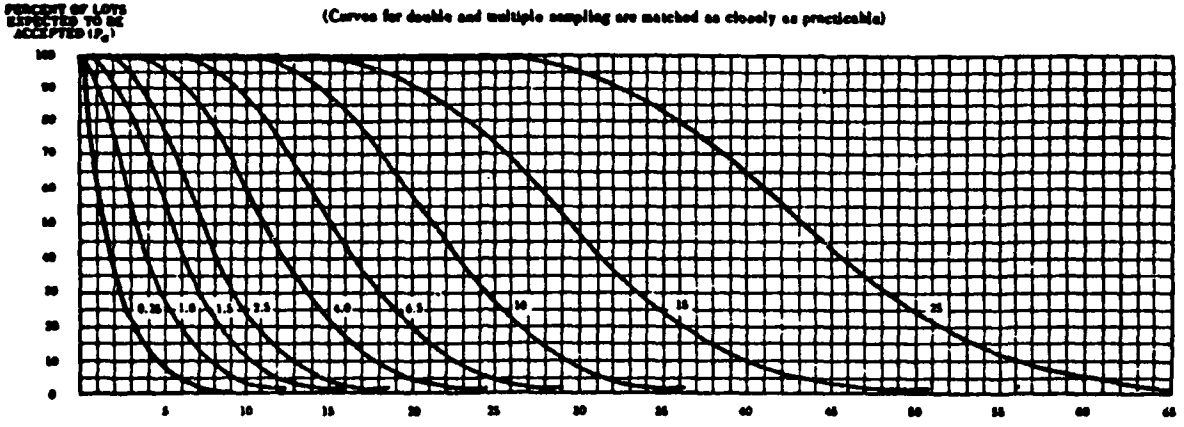
• = Use single sampling plan above (or alternatively use letter K).

▫ = Acceptance not permitted at this sample size.

TABLE X-H—Tables for sample size code letter: H

CHART H - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection.

TABLE X-H-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																			
	0.25	1.0	1.5	2.5	4.0	6.5	X	10	0.25	1.0	1.5	2.5	4.0	6.5	X	10	X	15	X	25
	p (in percent defective)								p (in defects per hundred units)											
99.0	0.020	0.306	0.888	1.69	3.66	6.06	7.41	11.1	0.020	0.298	0.872	1.65	3.57	5.81	7.01	9.54	12.2	15.0	20.7	25.1
95.0	0.103	0.712	1.66	2.77	5.34	8.20	9.74	12.9	0.103	0.710	1.64	2.73	5.23	7.96	9.39	12.3	15.4	18.5	24.9	29.8
90.0	0.210	1.07	2.23	3.54	6.42	9.53	11.2	14.5	0.210	1.06	2.20	3.49	6.30	9.31	10.9	14.0	17.3	20.6	27.3	32.5
75.0	0.574	1.92	3.46	5.09	8.51	12.0	13.8	17.5	0.576	1.92	3.45	5.07	8.44	11.9	13.7	17.2	20.8	24.5	31.8	37.4
50.0	1.38	3.33	5.31	7.30	11.3	15.2	17.2	21.2	1.39	3.36	5.35	7.34	11.3	15.3	17.3	21.6	25.3	29.3	37.3	43.3
25.0	2.74	5.30	7.70	10.0	14.5	18.8	21.0	25.2	2.77	5.39	7.84	10.2	14.8	19.4	21.6	26.0	30.4	34.8	43.5	49.9
10.0	4.50	7.56	10.3	12.9	17.8	22.4	24.7	29.1	4.61	7.78	10.6	13.4	18.6	23.5	26.0	30.8	35.6	40.3	49.5	56.4
5.0	5.82	9.13	12.1	14.8	19.9	24.7	27.0	31.6	5.99	9.49	12.6	15.5	21.0	26.3	28.9	33.9	38.9	43.8	53.4	60.5
1.0	8.80	12.5	15.9	18.8	24.3	29.2	31.7	36.3	9.21	13.3	16.8	20.1	26.2	32.0	34.8	40.3	45.6	50.9	61.1	68.7
	0.40	1.5	2.5	4.0	6.5	X	10	X	0.40	1.5	2.5	4.0	6.5	X	10	X	15	X	25	X
	Acceptable Quality Levels (tightened inspection)																			

Note: Binomial distribution used for percent defective computations; Poisson for defects per hundred units.

TABLE X-H-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: H

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																												Cumulative sample size
		Less than 0.25		0.25		0.40		✕		0.65		1.0		1.5		2.5		4.0		6.5		✕		10		✕		15		✕		25		Higher than 25		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	50	▽		0	1	Use Letter G		Use Letter K		Use Letter J		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		50
Double	32	▽		•								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		32
	64											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			64
Multiple	13	▽		•								*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		13
	26											*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			26
	39											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			39
	52											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			52
	65											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			65
	78											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			78
	91											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			91
		Less than 0.40		0.40		✕		0.65		1.0		1.5		2.5		4.0		6.5		✕		10		✕		15		✕		25		✕		Higher than 25		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

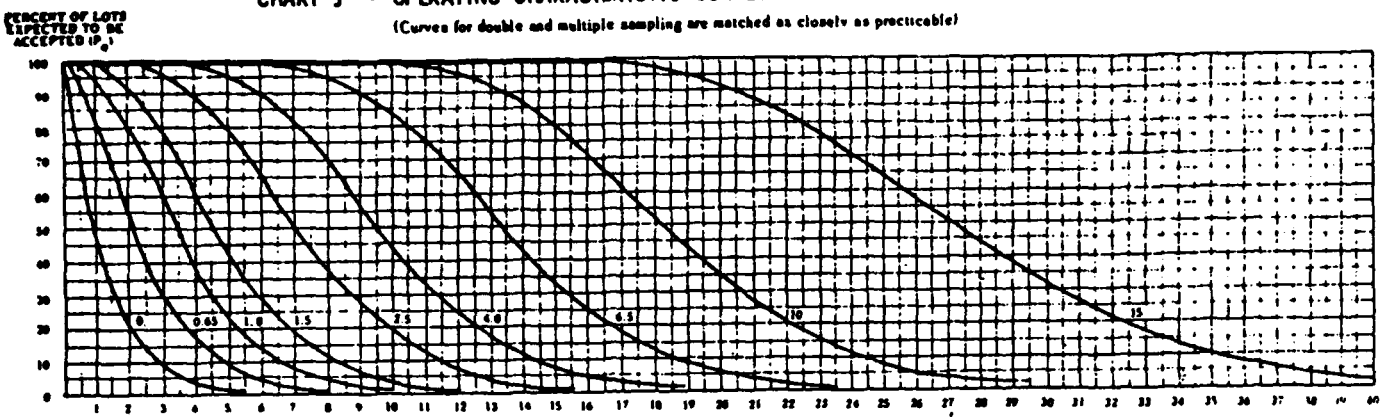
• = Use single sampling plan above (or alternatively use letter L).

* = Acceptance not permitted at this sample size.

TABLE X-J—Tables for sample size code letter: J

CHART J - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤10; in defects per hundred units for AQL's >10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-J-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																				
	0.15	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	0.15	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15
	p (in percent defective)										p (in defects per hundred units)											
99.0	0.013	0.188	0.550	1.05	2.30	3.72	4.50	6.13	7.88	9.75	0.013	0.186	0.545	1.03	2.23	3.63	4.38	5.96	7.62	9.35	12.9	15.7
95.0	0.064	0.444	1.03	1.73	3.32	5.06	5.98	7.91	9.89	11.9	0.064	0.444	1.02	1.71	3.27	4.98	5.87	7.71	9.61	11.6	15.6	18.6
90.0	0.132	0.666	1.38	2.20	3.98	5.91	6.91	8.95	11.0	13.2	0.131	0.665	1.38	2.18	3.94	5.82	6.79	8.78	10.8	12.9	17.1	20.3
75.0	0.359	1.202	2.16	3.18	5.30	7.50	8.62	10.9	13.2	15.5	0.360	1.20	2.16	3.17	5.27	7.45	8.55	10.8	13.0	15.3	19.9	23.4
50.0	0.863	2.09	3.33	4.57	7.06	9.55	10.8	13.3	15.8	18.3	0.866	2.10	3.34	4.59	7.09	9.59	10.8	13.3	15.8	18.3	23.3	27.1
25.0	1.72	3.33	4.84	6.31	9.14	11.9	13.3	16.0	18.6	21.3	1.73	3.37	4.90	6.39	9.28	12.1	13.5	16.3	19.0	21.8	27.2	31.2
10.0	2.84	4.78	6.52	8.16	11.3	14.2	15.7	18.6	21.4	24.2	2.88	4.86	6.65	8.35	11.6	14.7	16.2	19.3	22.2	25.2	30.9	35.2
5.0	3.68	5.80	7.66	9.39	12.7	15.8	17.3	20.3	23.2	26.0	3.75	5.93	7.87	9.69	13.1	16.4	18.0	21.2	24.3	27.4	33.4	37.8
1.0	5.59	8.00	10.1	12.0	15.6	18.9	20.5	23.6	26.5	29.5	5.76	8.30	10.5	12.6	16.4	20.0	21.8	25.2	28.5	31.8	38.2	42.9
	0.25	1.0	1.5	2.5	4.0	X	6.5	X	10	X	0.25	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15	X
	Acceptable Quality Levels (tightened inspection)																					

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial.

TABLE X-J-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: J

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																												Cumulative sample size
		Less than 0.15		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		Higher than 15					
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	80	▽		0	1	Use Letter H		Use Letter L		Use Letter K		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		80
Double	50	▽		•								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		50
	100											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			100
Multiple	20	▽		•								▫	2	▫	2	▫	3	▫	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		20
	40											▫	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			40
	60											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	9	13	11	17	13	19			60
	80											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			80
	100											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			100
	120											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			120
	140											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			140
		Less than 0.25		0.25				0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		Higher than 15					
		Acceptable Quality Levels (tightened inspection)																												

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

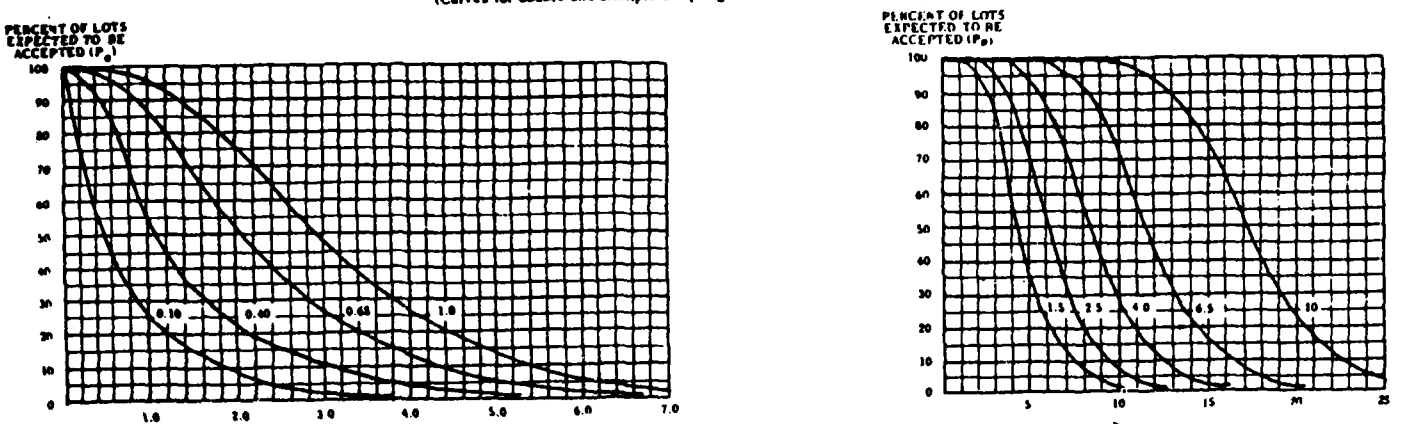
• = Use single sampling plan above (or alternatively use letter M)

▫ = Acceptance not permitted at this sample size.

TABLE X-K—Tables for sample size code letter: K

CHART K - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-K-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.10	0.40	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10
	p (in percent defective or defects per hundred units)											
99.0	0.0081	0.119	0.349	0.658	1.43	2.33	2.81	3.82	4.88	5.98	8.28	10.1
95.0	0.0410	0.284	0.654	1.09	2.09	3.19	3.76	4.94	6.15	7.40	9.95	11.9
90.0	0.0840	0.426	0.882	1.40	2.52	3.73	4.35	5.62	6.92	8.24	10.9	13.0
75.0	0.230	0.769	0.382	2.03	3.38	4.77	5.47	6.90	8.34	9.79	12.7	14.9
50.0	0.554	1.34	2.14	2.94	4.54	6.14	6.94	8.53	10.1	11.7	14.9	17.3
25.0	1.11	2.15	3.14	4.09	5.94	7.75	8.64	10.4	12.2	13.9	17.4	20.0
10.0	1.84	3.11	4.26	5.35	7.42	9.42	10.4	12.3	14.2	16.1	19.8	22.5
5.0	2.40	3.80	5.04	6.20	8.41	10.5	11.5	13.6	15.6	17.5	21.4	24.2
1.0	3.68	5.31	6.73	8.04	10.5	12.8	18.3	16.1	18.3	20.4	24.5	27.5
	0.15	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial.

TABLE X-K-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: K

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																												Cumulative sample size
		Less than 0.10		0.10		0.15		X		0.25		0.40		0.65		1.0		1.5		2.5		X		4.0		X		6.5		X		10		Higher than 10		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	125	▽		0	1	Use Letter J		Use Letter M		Use Letter L		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		125
Double	80	▽		•								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		80
	160											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			160
Multiple	32	▽		•								*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		32
	64											*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			64
	96											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			96
	128											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			128
	160											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			160
	192											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			192
	224											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			224
		Less than 0.15		0.15		X		0.25		0.40		0.65		1.0		1.5		2.5		X		4.0		X		6.5		X		10		X		Higher than 10		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

• = Use single sampling plan above (or alternatively use letter N).

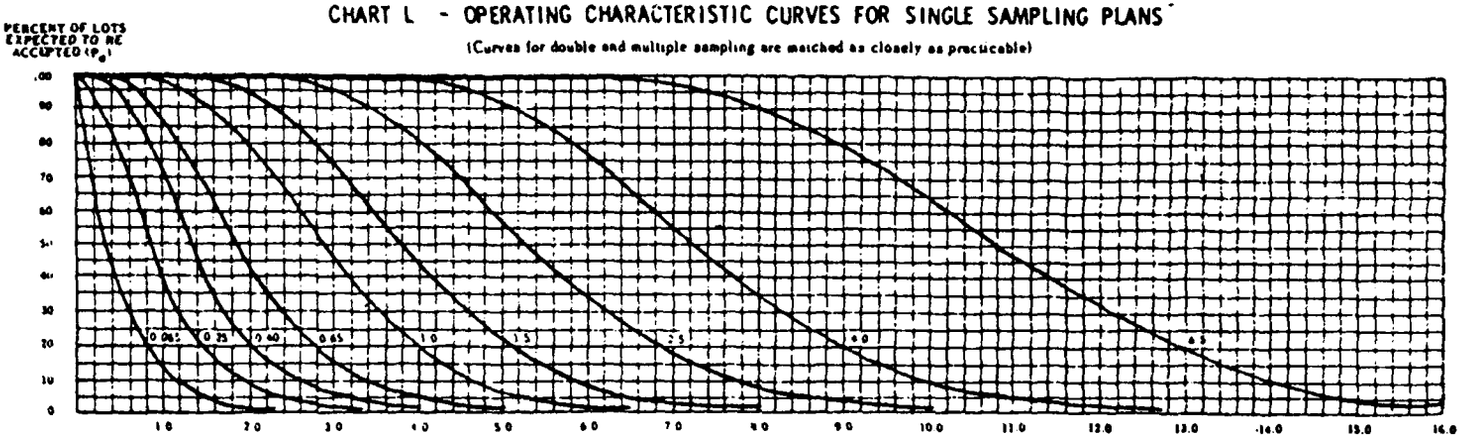
* = Acceptance not permitted at this sample size.

K

TABLE X-L—Tables for sample size code letter: L

CHART L - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-L-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.065	0.25	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5
	p (in percent defective or defects per hundred units)											
99.0	0.0051	0.075	0.218	0.412	0.893	1.45	1.75	2.39	3.05	3.74	5.17	6.29
95.0	0.0256	0.178	0.409	0.683	1.31	1.99	2.35	3.09	3.85	4.62	6.22	7.45
90.0	0.0525	0.266	0.551	0.873	1.58	2.33	2.72	3.51	4.32	5.15	6.84	8.12
75.0	0.144	0.481	0.864	1.27	2.11	2.98	3.42	4.31	5.21	6.12	7.95	9.34
50.0	0.347	0.839	1.34	1.84	2.84	3.84	4.33	5.33	6.33	7.33	9.33	10.8
25.0	0.693	1.35	1.96	2.56	3.71	4.84	5.40	6.51	7.61	8.70	10.9	12.5
10.0	1.15	1.95	2.66	3.34	4.64	5.89	6.50	7.70	8.89	10.1	12.4	14.1
5.0	1.50	2.37	3.15	3.88	5.26	6.57	7.22	8.48	9.72	10.9	13.3	15.1
1.0	2.30	3.32	4.20	5.02	6.55	8.00	8.70	10.1	11.4	12.7	15.3	17.2
	0.10	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial.

TABLE X-L-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: L

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																								Cumulative sample size
		Less than 0.065		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		Higher than 6.5		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	200	▽		0	1	Use Letter K		Use Letter N		Use Letter M		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		200
Double	125	▽		*								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		125
	250											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			250
Multiple	50	▽		*								ø	2	ø	2	ø	3	ø	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		50
	100											ø	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			100
	150											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			150
	200											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			200
	250											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			250
	300											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			300
	350											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			350
		Less than 0.10		0.10				0.15		0.25		0.40		0.65		1.0		1.5				2.5				4.0				6.5				Higher than 6.5		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

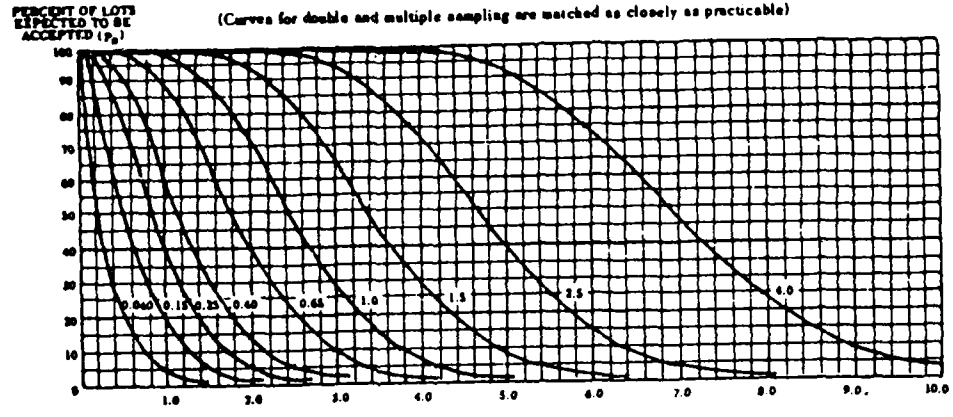
Re = Rejection number

* = Use single sampling plan above (or alternatively use letter P).

ø = Acceptance not permitted at this sample size.

CHART M - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection.

TABLE X-M-1 - TABULATED VALUES FOR OPERATING CHARACTERSTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.040	0.15	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0
	p (in percent defective or in dejects per hundred units)											
99.0	0.0032	0.047	0.138	0.261	0.566	0.922	1.11	1.51	1.94	2.38	3.28	3.99
95.0	0.0163	0.112	0.259	0.433	0.829	1.26	1.49	1.96	2.44	2.94	3.95	4.73
90.0	0.0333	0.168	0.349	0.533	1.00	1.48	1.72	2.23	2.75	3.27	4.34	5.16
75.0	0.0914	0.305	0.580	0.804	1.34	1.89	2.17	2.74	3.31	3.89	5.05	5.93
50.0	0.220	0.532	0.848	1.17	1.80	2.43	2.75	3.39	4.02	4.66	5.93	6.88
25.0	0.440	0.854	1.24	1.62	2.36	3.07	3.43	4.13	4.83	5.52	6.90	7.92
10.0	0.731	1.23	1.69	2.12	2.94	3.74	4.13	4.89	5.65	6.39	7.86	8.95
5.0	0.951	1.51	2.00	2.46	3.34	4.17	4.58	5.38	6.17	6.95	8.47	9.60
1.0	1.46	2.11	2.67	3.19	4.16	5.08	X	5.53	X	6.40	X	7.25	X	8.08	X	9.71	X	10.9
	0.065	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial

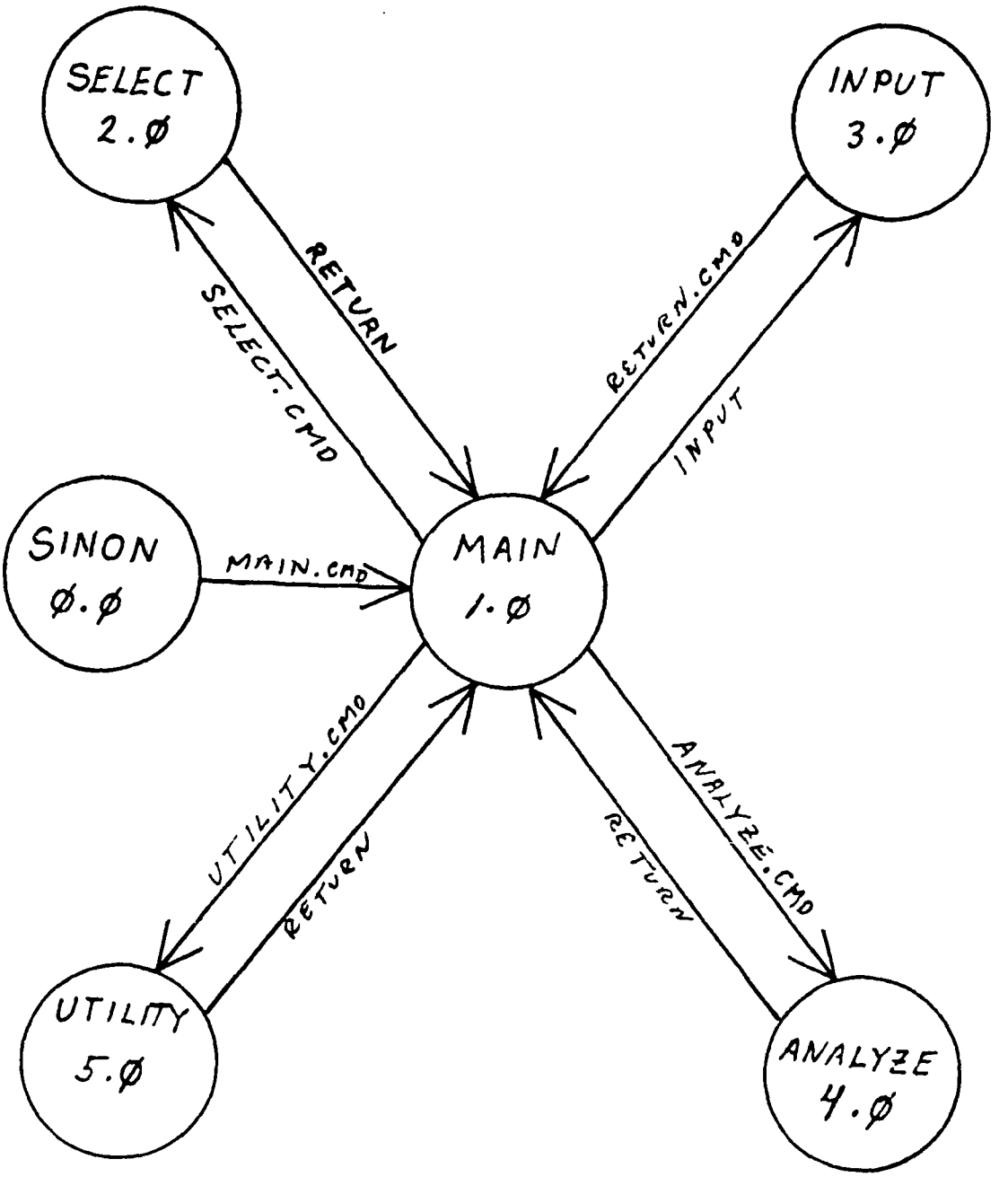


Figure 2. First Expansion - Main Module

APPENDIX B
AQAS SYSTEM DATA-FLOW DIAGRAMS

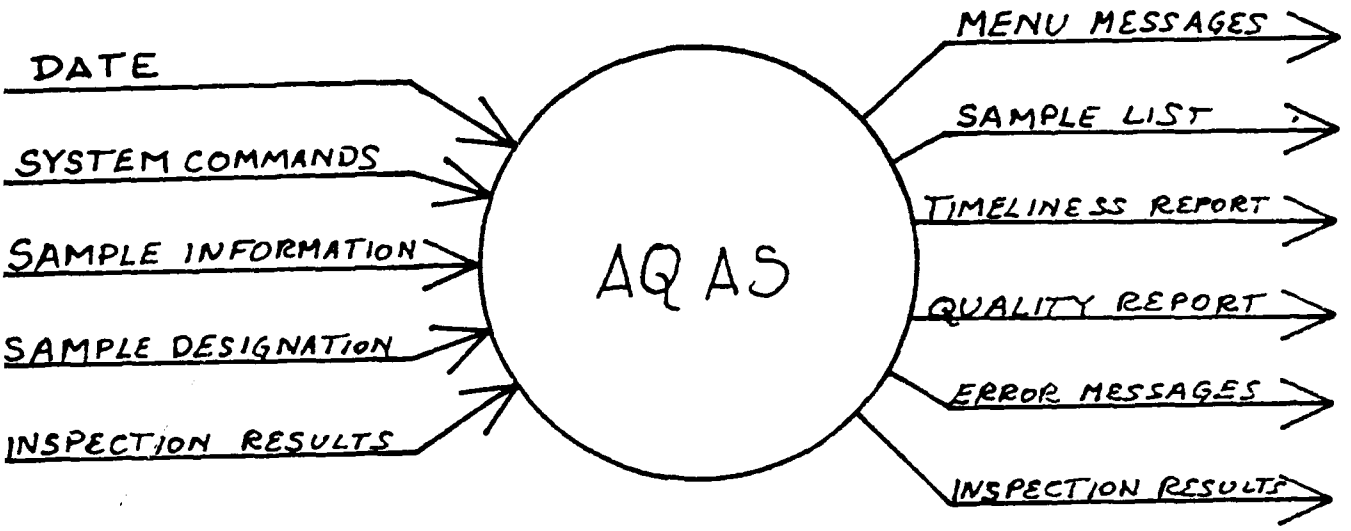


Fig. 1 System Overview

Copies of this standard may be obtained by directing requests to:

Commanding Officer
U.S. Naval Supply Depot
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5801 Tabor Avenue
Philadelphia 20, Pennsylvania

Copies of this Military Standard may be obtained for other than official use by individuals, firms, and contractors from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.

Both the title and identifying symbol number should be stipulated when requesting copies of Military Standards.

Custodians:

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Navy - Bureau of Weapons
Air Force - Air Force Logistics Command
Defense Supply Agency

Preparing Activity:

Army - Munitions Command

☆U.S. GOVERNMENT PRINTING OFFICE: 1980-603-121/4090

Index of terms with special meanings

S

TABLE X-S—Tables for sample size code letter: S

Type of sampling plan	Cumulative sample size	Acceptable Quality Level (normal inspection)	
		X	
		Ac	Re
Single	3150	1	2
Double	2000	0	2
	4000	1	2
Multiple	800	*	2
	1600	*	2
	2400	0	2
	3200	0	3
	4000	1	3
	4800	1	3
	5600	2	3
		0.025	
		Acceptable Quality Level (tightened inspection)	

Ac = Acceptance number

Re = Rejection number

* = Acceptance not permitted at this sample size.

TABLE X-R-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: R

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																								Cumulative sample size
		X		0.010		0.015		X		0.025		0.040		0.065		0.10		0.15		X		0.25		X		0.40		X		0.65		Higher than 0.65		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	2000	0	1	Use Letter Q		Use Letter P		Use Letter S		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		2000
Double	1250	*								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		1250
	2500									1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			2500
Multiple	500									*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		500
	1000									*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			1000
	1500									0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			1500
	2000	*								0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			2000
	2500									1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			2500
	3000									1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			3000
	3500									2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			3500
		0.010		0.015		X		0.025		0.040		0.065		0.10		0.15		X		0.25		X		0.40		X		0.65		X		Higher than 0.65		
		Acceptable Quality Levels (tightened inspection)																															

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

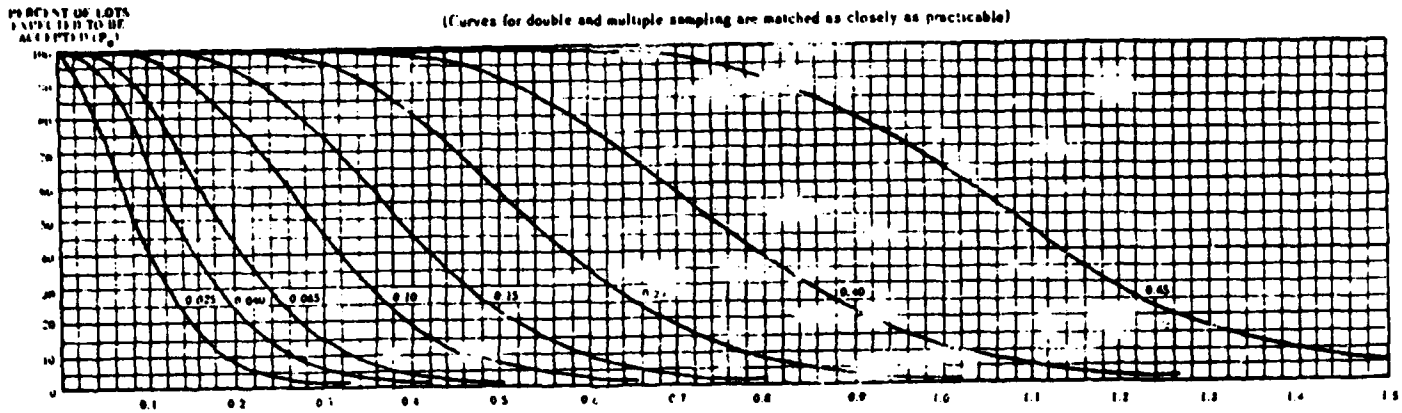
* = Use single sampling plan above

= Acceptance not permitted at this sample size

TABLE X-R—Tables for sample size code letter: R

CHART R - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p — in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-R-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)										
	0.025	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65
	p (in percent defective or defects per hundred units)										
99.0	0.0074	0.0218	0.0412	0.0802	0.145	0.175	0.239	0.305	0.374	0.517	0.629
95.0	0.0178	0.0409	0.0683	0.131	0.199	0.235	0.309	0.385	0.462	0.622	0.745
90.0	0.0266	0.0551	0.0873	0.158	0.233	0.272	0.351	0.432	0.515	0.684	0.812
75.0	0.0481	0.0868	0.127	0.211	0.298	0.3[illegible]	0.431	0.521	0.612	0.795	0.934
50.0	0.0839	0.134	0.184	0.284	0.384	0.433	0.533	0.633	0.733	0.933	1.08
25.0	0.135	0.196	0.256	0.371	0.484	0.540	0.651	0.761	0.870	1.09	1.25
10.0	0.195	0.266	0.334	0.464	0.589	0.650	0.770	0.889	1.01	1.24	1.41
5.0	0.237	0.315	0.388	0.526	0.657	0.722	0.848	0.972	1.09	1.33	1.51
1.0	0.332	0.420	0.502	0.655	0.800	0.870	1.02	1.14	1.27	1.53	1.72
	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65	X
	Acceptable Quality Levels (tightened inspection)										

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial

TABLE X-Q-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: Q

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																						Cumulative sample size
		X		0.010		0.015	X		0.025		0.040		0.065		0.10		0.15		0.25	X		0.40	X	0.65	X	1.0		Higher than 1.0		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	1250	Use Letter R		0	1	Use Letter P	Use Letter S	Use Letter R		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	Δ		1250
Double	800			*						0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	Δ		800
	1600									1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			1600
Multiple	315			*						ø	2	ø	2	ø	3	ø	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	Δ		315
	630									ø	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			630
	945									0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			945
	1260									0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			1260
	1575									1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			1575
	1890									1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			1890
	2205									2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			2205
		0.010		0.015		X	0.025	0.040		0.065		0.10		0.15		0.25	X	0.40		X	0.65	X		1.0	X		Higher than 1.0				
		Acceptable Quality Levels (tightened inspection)																													

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

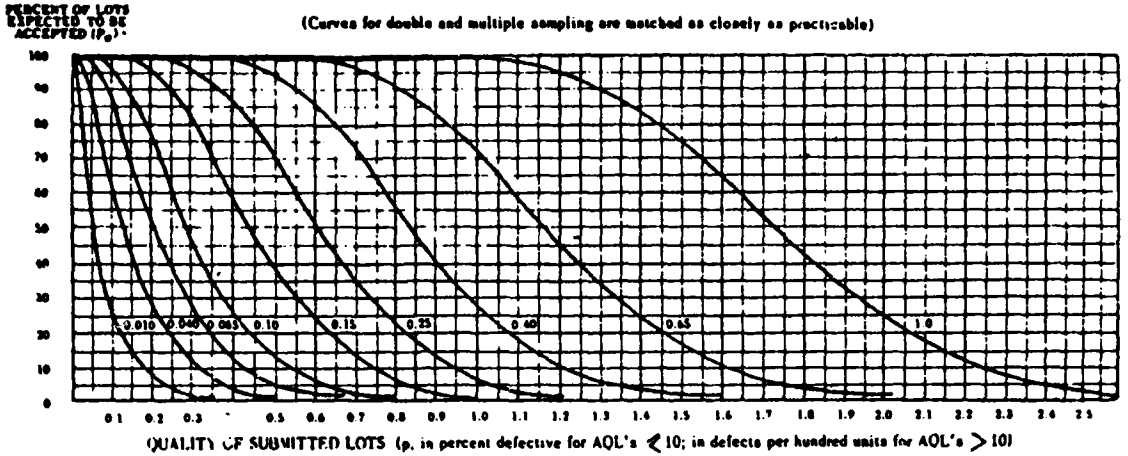
* = Use single sampling plan above.

ø = Acceptance not permitted at this sample size.

TABLE X-Q—Tables for sample size code letter: Q

CHART Q - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-Q-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.010	0.040	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0
	p (in percent defective or defects per hundred units											
99.0	0.00081	0.0119	0.0349	0.0656	0.143	0.232	0.281	0.382	0.488	0.598	0.828	1.01
95.0	0.00410	0.0284	0.0654	0.109	0.209	0.318	0.376	0.494	0.615	0.740	0.995	1.19
90.0	0.00840	0.0426	0.0882	0.140	0.252	0.372	0.435	0.562	0.692	0.824	1.09	1.30
75.0	0.0230	0.0769	0.138	0.203	0.338	0.476	0.547	0.690	0.834	0.979	1.27	1.49
50.0	0.0554	0.134	0.214	0.294	0.454	0.614	0.694	0.853	1.01	1.17	1.49	1.73
25.0	0.111	0.215	0.314	0.409	0.594	0.775	0.864	1.04	1.22	1.39	1.74	2.00
10.0	0.184	0.310	0.426	0.534	0.742	0.942	1.04	1.23	1.42	1.61	1.98	2.25
5.0	0.240	0.380	0.504	0.620	0.841	1.05	1.15	1.36	1.56	1.75	2.14	2.42
1.0	0.368	0.531	0.672	0.804	1.05	1.28	1.83	1.61	1.83	2.04	2.45	2.75
	0.015	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial

TABLE X-P-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: P

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																												Cumulative sample size
		0.010		0.015		0.025		X		0.040		0.065		0.10		0.15		0.25		0.40		X		0.65		X		1.0		X		1.5		Higher than 1.5		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	800	▽		0	1	Use Letter N		Use Letter R		Use Letter Q		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		800
Double	500	▽		•								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		500
	1000											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			1000
Multiple	200	▽		•								#	2	#	2	#	3	#	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		200
	400											#	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			400
	600											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			600
	800											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			800
	1000											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			1000
	1200											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			1200
	1400											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			1400
		Less than 0.025		0.025		X		0.040		0.065		0.10		0.15		0.25		0.40		X		0.65		X		1.0		X		1.5		X		Higher than 1.5		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

• = Use single sampling plan above.

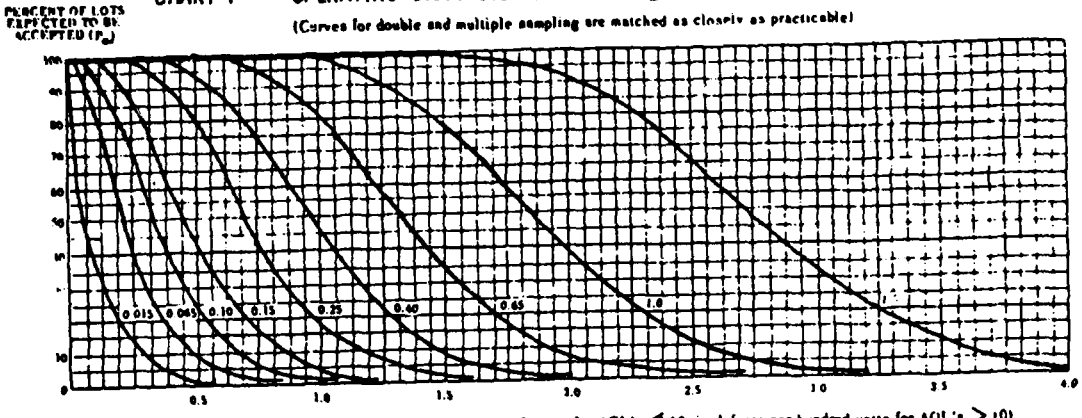
= Acceptance not permitted at this sample size.

P

TABLE X-P — Tables for sample size code letter: P

CHART P - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection

TABLE X-P-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.015	0.065	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5
	p (in percent defective or defects per hundred units)											
99.0	0.0013	0.0186	0.055	0.103	0.223	0.363	0.438	0.596	0.762	0.935	1.29	1.57
95.0	0.0064	0.0444	0.102	0.171	0.327	0.498	0.587	0.771	0.961	1.16	1.56	1.86
90.0	0.0131	0.0665	0.138	0.218	0.394	0.582	0.679	0.878	1.08	1.29	1.71	2.03
75.0	0.0360	0.120	0.216	0.317	0.527	0.745	0.855	1.08	1.30	1.53	1.99	2.34
50.0	0.0866	0.210	0.334	0.459	0.709	0.959	1.08	1.33	1.58	1.83	2.33	2.71
25.0	0.173	0.337	0.490	0.639	0.928	1.21	1.35	1.63	1.90	2.18	2.72	3.12
10.0	0.288	0.486	0.665	0.835	1.16	1.47	1.62	1.93	2.22	2.52	3.09	3.52
5.0	0.375	0.593	0.787	0.969	1.31	1.64	1.80	2.12	2.43	2.74	3.34	3.78
1.0	0.576	0.830	1.05	1.26	1.64	2.00	2.18	2.52	2.85	3.18	3.82	4.29
	0.025	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial

TABLE X-N-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: N

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																														Cumulative sample size
		Less than 0.025		0.025		0.040		X		0.065		0.10		0.15		0.25		0.40		0.65		X		1.0		X		1.5		X		2.5		Higher than 2.5		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	500	▽		0	1	Use Letter M		Use Letter Q		Use Letter P		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		500
Double	315	▽		*								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	14	11	16	△		315
	630											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	24	26	27			630
Multiple	125	▽		*								*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		125
	250											*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			250
	375											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			375
	500											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			500
	625											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			625
	750											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			750
	875											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			875
		Less than 0.040		0.040		X		0.065		0.10		0.15		0.25		0.40		0.65		X		1.0		X		1.5		X		2.5		X		Higher than 2.5		
		Acceptable Quality Levels (tightened inspection)																																	

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number

Re = Rejection number

* = Use single sampling plan above (or alternatively use letter R)

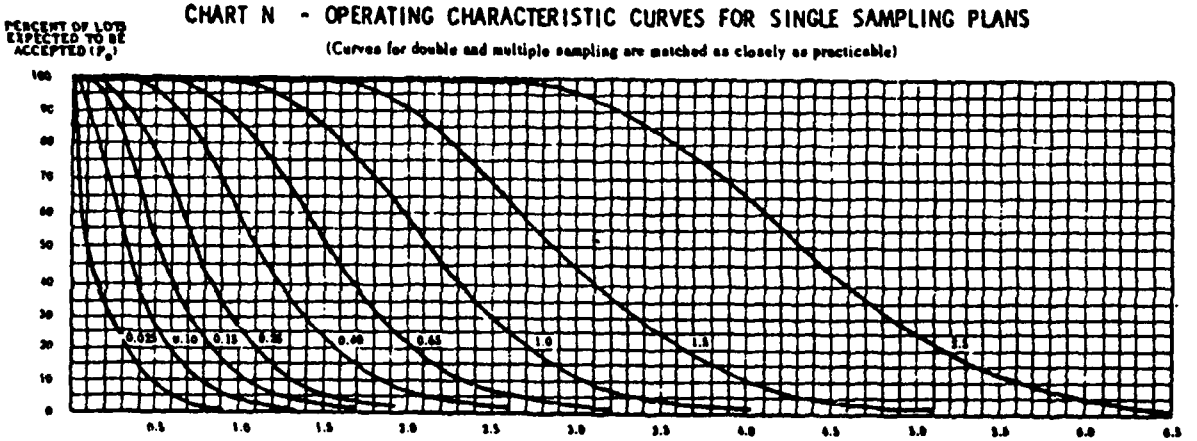
\# = Acceptance not permitted at this sample size.

N

TABLE X-N—Tables for sample size code letter: N

CHART N - OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



QUALITY OF SUBMITTED LOTS (p, in percent defective for AQL's ≤ 10; in defects per hundred units for AQL's > 10)

Note: Figures on curves are Acceptable Quality Levels (AQL's) for normal inspection.

TABLE X-N-1 - TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.025	0.10	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	2.5
	p (in percent defective or in defects per hundred units)											
99.0	0.0020	0.030	0.087	0.165	0.357	0.581	0.701	0.954	1.22	1.50	2.07	2.51
95.0	0.0103	0.071	0.164	0.273	0.523	0.796	0.939	1.23	1.54	1.85	2.49	2.98
90.0	0.0210	0.106	0.220	0.349	0.630	0.931	1.09	1.40	1.73	2.06	2.73	3.25
75.0	0.0576	0.192	0.345	0.507	0.844	1.19	1.37	1.72	2.08	2.45	3.18	3.74
50.0	0.139	0.336	0.535	0.734	1.13	1.53	1.73	2.13	2.53	2.93	3.73	4.33
25.0	0.277	0.539	0.784	1.02	1.48	1.94	2.16	2.60	3.04	3.48	4.35	4.99
10.0	0.461	0.778	1.06	1.34	1.86	2.35	2.60	3.08	3.56	4.03	4.95	5.64
5.0	0.599	0.949	1.26	1.55	2.10	2.63	2.89	3.39	3.89	4.38	5.34	6.05
1.0	0.921	1.328	1.68	2.01	2.62	3.20	3.48	4.03	4.56	5.09	6.12	6.87
	0.040	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	2.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: All values given in above table based on Poisson distribution as an approximation to the Binomial

TABLE X-M-2 - SAMPLING PLANS FOR SAMPLE SIZE CODE LETTER: M

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																						Cumulative sample size
		Less than 0.040		0.040		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		Higher than 4.0		
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	
Single	315	▽		0	1	Use Letter L		Use Letter P		Use Letter N		1	2	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	15	18	19	21	22	△		315
Double	200	▽		*								0	2	0	3	1	4	2	5	3	7	3	7	5	9	6	10	7	11	9	16	11	16	△		200
	400											1	2	3	4	4	5	6	7	8	9	11	12	12	13	15	16	18	19	23	26	26	27			400
Multiple	80	▽		*								*	2	*	2	*	3	*	4	0	4	0	4	0	5	0	6	1	7	1	8	2	9	△		80
	160											*	2	0	3	0	3	1	5	1	6	2	7	3	8	3	9	4	10	6	12	7	14			160
	240											0	2	0	3	1	4	2	6	3	8	4	9	6	10	7	12	8	13	11	17	13	19			240
	320											0	3	1	4	2	5	3	7	5	10	6	11	8	13	10	15	12	17	16	22	19	25			320
	400											1	3	2	4	3	6	5	8	7	11	9	12	11	15	14	17	17	20	22	25	25	29			400
	480											1	3	3	5	4	6	7	9	10	12	12	14	14	17	18	20	21	23	27	29	31	33			480
	560											2	3	4	5	6	7	9	10	13	14	14	15	18	19	21	22	25	26	32	33	37	38			560
		Less than 0.065		0.065				0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		Higher than 4.0		
		Acceptable Quality Levels (tightened inspection)																										

△ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

* = Use single sampling plan above (or alternatively use letter Q).

\# = Acceptance not permitted at this sample size.

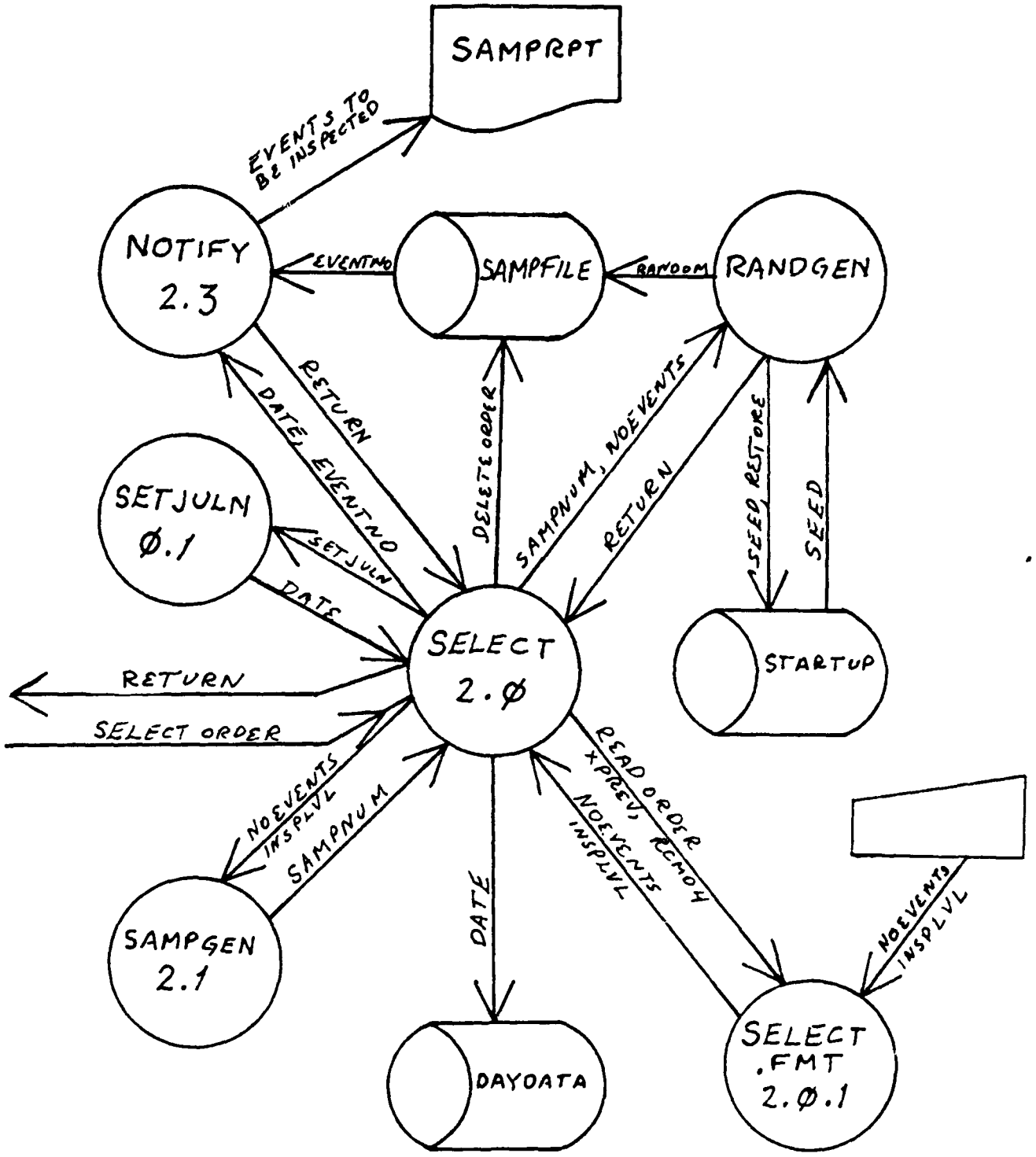
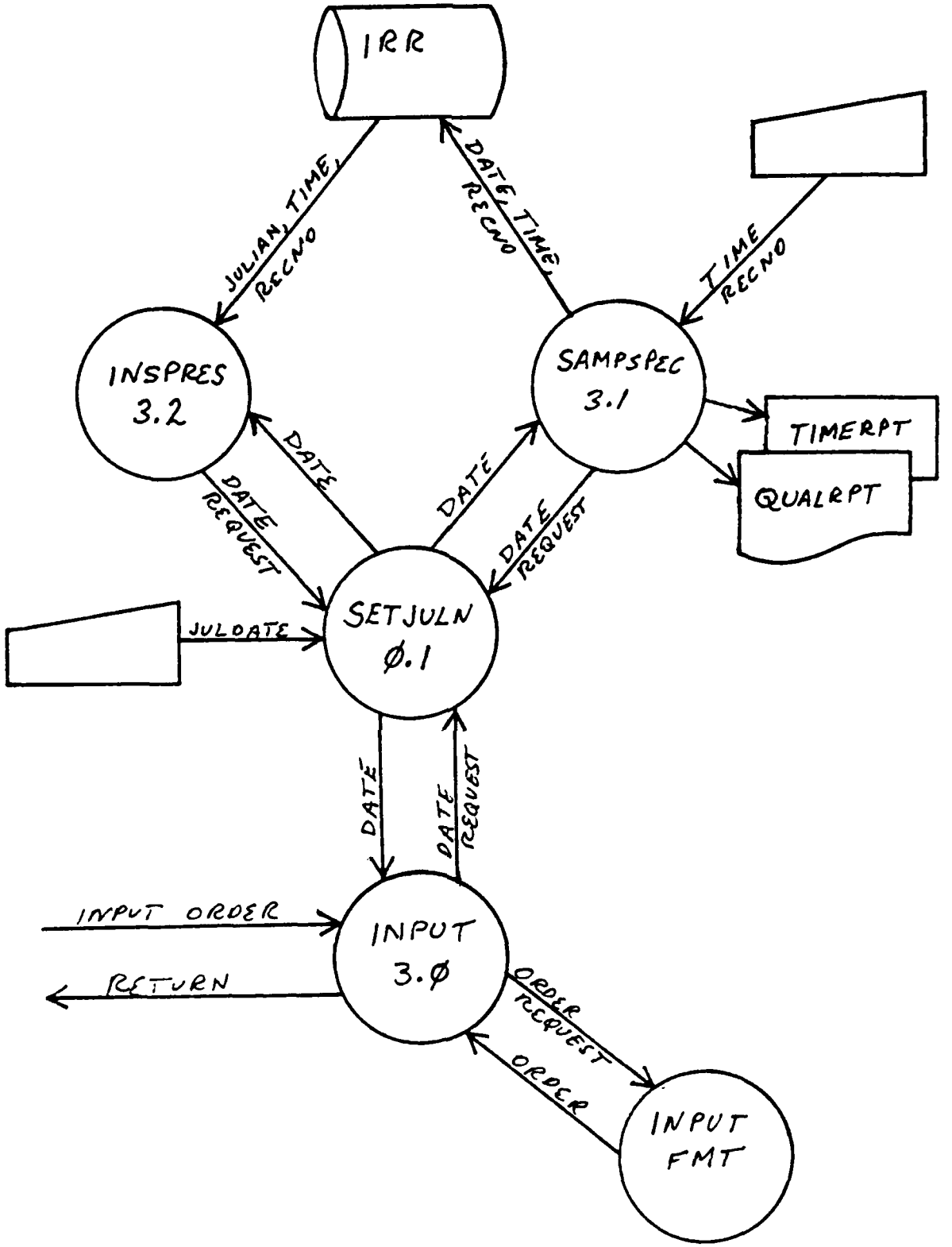


Figure 3. First Expansion - Select Module



Picure 4. First Expansion - Input Module

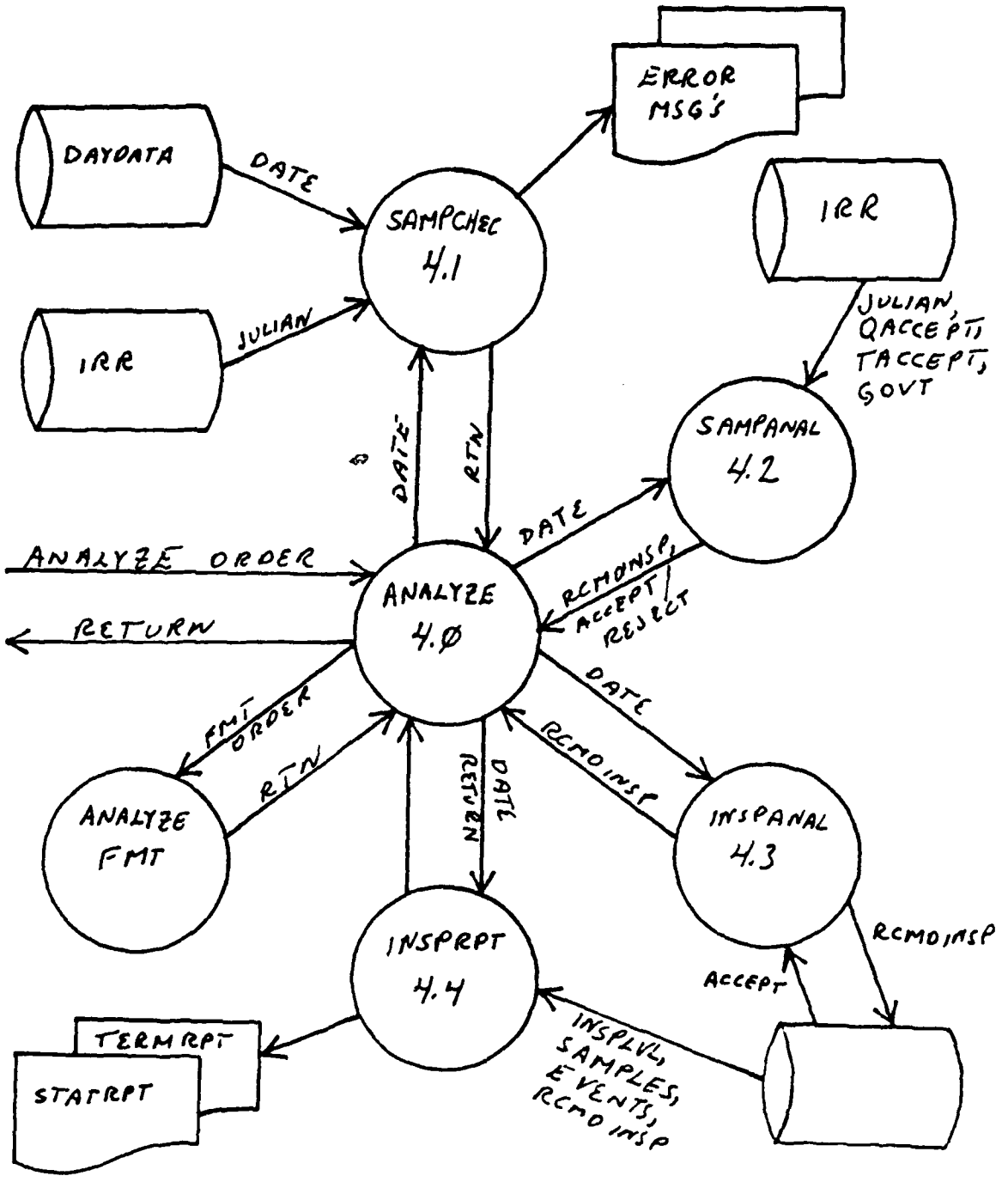


Figure 5. First Expansion - Analyze Module

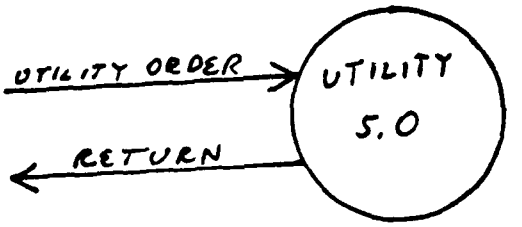


Figure 7. First Expansion - Utility Module

APPENDIX C
AQAS SYSTEM CODE

```
* MODULE 0.0
* SINON.CMD    VERSION 1.0    20 MAR 84      HEM

* This module welcomes the user to the Automated Quality Assurance
* System.

* Format file used: SINON.FMT

* Display logon message.
SET FORMAT TO sinon

READ

DO delay2

* Commence program
DO main
```

```
* MODULE 0.0.1
* SINON.FMT    VERSION 1.0    20 MAR 84      HEM

@  0, 0 SAY "+================================================="
@  0,50 SAY "==============================+"
@  1, 0 SAY "!"
@  1,79 SAY "!"
@  2, 0 SAY "!"
@  2,79 SAY "!"
@  3, 0 SAY "!                              AUTOMATED QUALITY ASSURANCE"
@  3,51 SAY "PROGRAM                             !"
@  4, 0 SAY "!                               Utilizing MIL-STD 105"
@  4,50 SAY "D                               !"
@  5, 0 SAY "!"
@  5,79 SAY "!"
@  6, 0 SAY "!"
@  6,79 SAY "!"
@  7, 0 SAY "!                                   Developed for"
@  7,79 SAY "!"
@  8, 0 SAY "!"
@  8,79 SAY "!"
@  9, 0 SAY "!                            THE NAVAL REGIONAL DATA AUTOMA"
@  9,50 SAY "TION CENTER                         !"
@ 10, 0 SAY "!                                 San Francisco, CA."
@ 10,79 SAY "!"
@ 11, 0 SAY "!"
@ 11,79 SAY "!"
@ 12, 0 SAY "!"
@ 12,79 SAY "!"
@ 13, 0 SAY "!"
@ 13,79 SAY "!"
@ 14, 0 SAY "!                                        by"
@ 14,79 SAY "!"
@ 15, 0 SAY "!"
@ 15,79 SAY "!"
@ 16, 0 SAY "!                                  LT Howard E. Morton, U"
@ 16,50 SAY "SN                                 !"
@ 17, 0 SAY "!"
@ 17,79 SAY "!"
@ 18, 0 SAY "!                                  Naval Postgraduate Sch"
@ 18,50 SAY "ool                                !"
@ 19, 0 SAY "!                                       Monterey, CA."
@ 19,79 SAY "!"
@ 20, 0 SAY "!"
@ 20,79 SAY "!"
@ 21, 0 SAY "!"
@ 21,79 SAY "!"
@ 22, 0 SAY "+================================================="
@ 22,50 SAY "==============================+"
```

```
* MODULE 0.1
* SETJULN.CMD        VERSION 1.2     25 MAR 84       HEM

* This module allows the user to enter or change the Julian
* date of the QA action to be performed.

* FMT FILE USED: setjuln
* CALLED BY: main.cmd

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Prevent calculations showing on screen
SET TALK OFF

* Initialize variables
STORE 0 TO date

* Define format
SET FORMAT TO setjuln

* Execute
READ

LOCATE ALL FOR julian = date
IF EOF
   APPEND BLANK
   REPLACE julian WITH date
ENDIF


* Return to calling program
RETURN
```

```
* MODULE 0.0.1
* SETJULN.FMT  VERSION 1.0    25 MAR 84      HEM

@  4, 8 SAY "Specify Julian Date for"
@  4,32 SAY mode
@  5, 0 SAY "+================================================"
@  5,50 SAY "==============================+"
@  6, 0 SAY "!"
@  6,79 SAY "!"
@  7, 0 SAY "!    For which Julian date do you want to take act"
@  7,50 SAY "ion?"
@  7,55 GET date
@  7,79 SAY "!"
@  8, 0 SAY "!"
@  8,79 SAY "!"
@  9, 0 SAY "+================================================"
@  9,50 SAY "==============================+"
```

```
* MODULE 0.2.2
* DELAY2.CMD

* This module provides a short delay to allow the user to read a
* screen before the program moves on.

SET TALK OFF
STORE 1 TO tx
DO WHILE tx < 200
   STORE tx + 1 TO tx
ENDDO
ERASE
RELEASE ALL LIKE tx
RETURN
```

```
* MODULE 0.2.5
* DELAY5.CMD

* This module provides a short delay to allow the user to read a
* screen before the program moves on.

SET TALK OFF
STORE 1 TO tx
DO WHILE tx < 500
   STORE tx + 1 TO tx
ENDDO
ERASE
RELEASE ALL LIKE tx
RETURN
```

```
* MODULE 1.0
* MAIN.CMD VERSION 2.4     12 APR 84       HEM

* This is the main program of the Automated Quality Assurance
* System.
*
* FMT FILE USED: MAIN.fmt
* CALLED BY: LOGON.CMD

* Allow both upper and lower case inputs
SET EXACT OFF

SAVE TO keepem
CLEAR
RESTORE FROM keepem

STORE T TO go

* Set up the loop
 DO WHILE go

   * Set up screen and prompts
   SET FORMAT TO main

   STORE " " TO command

   READ
   * Perform selected function
   DO CASE

      CASE command = "1"
         DO select

      CASE command = "2"
         DO input

      CASE command = "3"
         DO analyze

      CASE command = "4"
         DO utility

      CASE command = "^"
         ERASE
         *Prevent the dBASE II sign-off message
         SET CONSOLE OFF
         QUIT

      CASE command = "%"
         ERASE
         CLEAR
```

```
            CANCEL

      ENDCASE
         RELEASE command
ENDDO
```

```
* MODULE 1.1
* MAIN.FMT     VERSION 2      12 APR 84      HEM

@  1,35 SAY "Main Menu"
@  2, 0 SAY "+================================================"
@  2,50 SAY "==============================+"
@  3, 0 SAY "!"
@  3,79 SAY "!"
@  4, 0 SAY "!    Welcome to NARDAC San Francisco's Automated Q"
@  4,50 SAY "uality Assurance System.     !"
@  5, 0 SAY "!    You have four options at this initial point:"
@  5,79 SAY "!"
@  6, 0 SAY "!"
@  6,79 SAY "!"
@  7, 0 SAY "!    1. Initiate the sample selection process."
@  7,79 SAY "!"
@  8, 0 SAY "!"
@  8,79 SAY "!"
@  9, 0 SAY "!    2. Input the sample and inspection data."
@  9,79 SAY "!"
@ 10, 0 SAY "!"
@ 10,79 SAY "!"
@ 11, 0 SAY "!    3. Analyze the data and generate reports."
@ 11,79 SAY "!"
@ 12, 0 SAY "!"
@ 12,79 SAY "!"
@ 13, 0 SAY "!    4. Go to the Utility Menu."
@ 13,79 SAY "!"
@ 14, 0 SAY "!"
@ 14,79 SAY "!"
@ 15, 0 SAY "!"
@ 15,79 SAY "!"
@ 16, 0 SAY "!    PLEASE CHOOSE ONE OPTION AT THIS TIME"
@ 16,44 GET command
@ 16,79 SAY "!"
@ 17, 0 SAY "!"
@ 17,79 SAY "!"
@ 18, 0 SAY "+================================================"
@ 18,50 SAY "==============================+"
```

```
* MODULE 2.0
* SELECT.CMD  VERSION 2.3        20 MAR 84        HEM

* This is the Sample Selection Module.
*
* FMT FILE USED: SELECT.FMT
* CALLED BY MAIN.CMD

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Restore seed value
RESTORE FROM startup ADDITIVE

* Prevent calculations from being shown on screen
SET TALK OFF

* Set up screens and prompts

STORE "Sample Selection" TO mode
STORE " " TO insplvl
STORE 0 TO noevents
STORE 0 TO sampnum
STORE 1 TO xcounter
STORE 0 TO xrandom
STORE "Normal" to rcmd1
STORE "Tightened" to rcmd2
STORE "Reduced" to rcmd3

DO setjuln
SET FORMAT TO select

USE b:daydata
LOCATE FOR julian = date
IF EOF
   APPEND BLANK
   REPLACE julian WITH date
ENDIF
SKIP -1
STORE rcmdinsp TO rcmd4
STORE julian TO xprev

* Define the file to be used, and clear it of previous entries.
USE b:sampfile
DELETE ALL
PACK

* Get number of events and inspection level from user.
READ
```

```
 MODULE 3.1
 SAMPSPEC.CMD    VERSION 1.2   10 MAR 84            HEM

 This module allows the user to input the IRR numbers to be
 inspected and then automatically generates the required
 timeliness and quality reports to be filled in by QAE
 personnel.

 THIS MODULE CALLED BY: INPUT.CMD

AVE TO keepem
LEAR
ESTORE FROM keepem

 Prevent calculations from showing on screen
ET TALK OFF

 Initialize variables
TORE Y TO t:more
TORE 0 TO t:TYM
TORE 0 TO t:R
TORE "Sample Identification" TO mode

O setjuln
SE b:irr

 Set up the loop
O WHILE t:more

   ERASE

   @ 2,2 SAY "JULIAN DATE "
   @ 2,14 SAY date
   ?
   ?
   APPEND BLANK

   REPLACE julian WITH date

   INPUT "Time" TO t:TYM
   REPLACE time WITH t:TYM

   INPUT "Record Number" TO t:R
   REPLACE recno WITH t:R

   INPUT "Any more IRR´s to enter for this date? (Y or N)" TO t:more

   DO timerpt
   DO qualrpt
   SET FORMAT TO PRINT
   EJECT
```

```
* MODULE 3.0.1
* INPUT1.FMT   VERSION 1.2    10 APR 84      HEM

@  1,35 SAY "Data Input"
@  2, 0 SAY "+================================================"
@  2,50 SAY "==============================+"
@  3, 0 SAY "!"
@  3,79 SAY "!"
@  4, 0 SAY "!    At this point you may choose one of four opti"
@  4,50 SAY "ons:                              !"
@  5, 0 SAY "!"
@  5,79 SAY "!"
@  6, 0 SAY "!    1. Enter IRR numbers"
@  6,79 SAY "!"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!    2. Enter inspection results"
@  8,79 SAY "!"
@  9, 0 SAY "!"
@  9,79 SAY "!"
@ 10, 0 SAY "!    3. Change the Julian Date, and enter data for"
@ 10,51 SAY "a different day              !"
@ 11, 0 SAY "!"
@ 11,79 SAY "!"
@ 12, 0 SAY "!    4. Return to the Main Menu"
@ 12,79 SAY "!"
@ 13, 0 SAY "!"
@ 13,79 SAY "!"
@ 14, 0 SAY "!    PLEASE CHOOSE ONE OPTION AT THIS TIME:"
@ 14,43 GET t:order
@ 14,79 SAY "!"
@ 15, 0 SAY "!"
@ 15,79 SAY "!"
@ 16, 0 SAY "+================================================"
@ 16,50 SAY "==============================+"
```

```
* MODULE 3.0
* INPUT.CMD      VERSION 1.5              12 APR 84           HEM

* This module allows the user to input the IRR numbers to be
* inspected, the results of the inspection process, and to make
* any changes to the IRR´s which may be required.

* CALLED BY MAIN.CMD

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Specify file to be used.
USE b:irr

* Prevent calculations from showing on screen
SET TALK OFF

* Initialize variables
STORE Y to t:Imore
STORE "Data Input" TO mode

* Set up DO loop
DO WHILE t:Imore

STORE " " TO t:order

SET FORMAT TO inputl
READ

   DO CASE

      CASE t:order = "1"
         DO sampspec

      CASE t:order = "2"
         DO inspres

      CASE t:order = "3"
         DO setjuln

      OTHERWISE
         STORE n TO t:Imore

   ENDCASE
ENDDO
* Release temporary memory variables
RELEASE ALL LIKE t:*
RETURN
```

```
* MODULE 2.3.2
* NOTIFY2.FMT       VERSION 1.0          12 APR 84       HEM

@  1,31 SAY "Sample Notification"
@  2, 0 SAY "+=================================================="
@  2,50 SAY "============================+"
@  3, 0 SAY "!"
@  3,79 SAY "!"
@  4, 0 SAY "!    This list delineates those events which you w"
@  4,50 SAY "ill be using for              !"
@  5, 0 SAY "!    inspection purposes. The"
@  5,29 SAY sampnum
@  5,42 SAY "samples have been calculated         !"
@  6, 0 SAY "!    by the system based on your input of"
@  6,42 SAY noevents
@  6,56 SAY "events and the         !"
@  7, 0 SAY "!    level of inspection desired. To use the list"
@  7,50 SAY "which will be provided       !"
@  8, 0 SAY "!    when this module is executed, read the sample"
@  8,51 SAY "number listed on the        !"
@  9, 0 SAY "!    form and compare it to the list you have for"
@  9,50 SAY "the computer center's        !"
@ 10, 0 SAY "!    operations for Julian date"
@ 10,31 SAY date
@ 10,46 SAY "The numbers this system          !"
@ 11, 0 SAY "!    has generated refer to the position of the ev"
@ 11,50 SAY "ents on that list          !"
@ 12, 0 SAY "!    (i.e.: Sample Number 5 refers to the 5th item"
@ 12,51 SAY "on the list, etc.),        !"
@ 13, 0 SAY "!    and this determines those events you must ins"
@ 13,50 SAY "pect according to          !"
@ 14, 0 SAY "!    published Quality Control Standards."
@ 14,79 SAY "!"
@ 15, 0 SAY "!"
@ 15,79 SAY "!"
@ 16, 0 SAY "+=================================================="
@ 16,50 SAY "============================+"
```

```
* MODULE 2.3.1
* NOTIFY1.FMT       VERSION 1.0          12 APR 84      HEM

@  0,30 SAY "Sample Notification"
@  1, 0 SAY "+================================================"
@  1,50 SAY "============================+"
@  2, 0 SAY "!"
@  2,79 SAY "!"
@  3, 0 SAY "!    At this point, the system has generated a ser"
@  3,50 SAY "ies of random numbers          !"
@  4, 0 SAY "!    which are equal in number to the number of sa"
@  4,50 SAY "mples that must be             !"
@  5, 0 SAY "!    taken given the number of events and the insp"
@  5,50 SAY "ection level you input         !"
@  6, 0 SAY "!    during the Sample Selection process, precedin"
@  6,50 SAY "g.                             !"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!    This is a good time to take a minute and read"
@  8,50 SAY "y the printer.                 !"
@  9, 0 SAY "!"
@  9,79 SAY "!"
@ 10, 0 SAY "!"
@ 10,79 SAY "!"
@ 11, 0 SAY "+================================================"
@ 11,50 SAY "============================+"
```

```
* MODULE 2.3
* NOTIFY.CMD          VERSION 1.3          9 MAY 84          HEM

* This module notifies Quality Assurance personnel of the
* events to be sampled.

* FMT FILES USED: NOTIFY1.FMT and NOTIFY2.FMT
* OUTPUT FORMS USED: SAMPRPT.FRM
* THIS MODULE CALLED BY: SELECT.CMD

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Input date into report header
STORE Y TO t:order
STORE STR(DATE,5) TO dte
SET HEADING TO INSPECTION LIST TOR JULIAN DATE &dte

* Specify file to be used
USE b:sampfile

* Arrange the file in numerical order
INDEX ON eventno TO b:samplist

* Display initial NOTIFY messages and cautions.
SET FORMAT TO notify1
READ

DO delay2

* Advise the user of the utilization of this list.
SET FORMAT TO notify2
READ
DO delay5

* Perform output in printed format

SET PRINT ON
REPORT FORM samprpt
EJECT
SET PRINT OFF

* Return to the Calling Program
RETURN
```

```
            APPEND BLANK
            REPLACE eventno WITH random
         ELSE
            STORE counter - 1 TO counter
         ENDIF

      ENDCASE
   ENDDO
* Save the seed value
SAVE TO startup ALL LIKE seed
ENDDO
RETURN
```

```
* MODULE 2.2
* RANDGEN.CMD  VERSION 1.1       3 MAR 84       HEM

* This is module generates n unique random samples where n =
*  sampnum,  and the range of n is from 1 to the number of events
*  for a given day (noevents).
*
* CALLED BY SELECT.CMD

* Generate n random samples, where n = sampnum, and range of n
* is from 1 to noevents.

SAVE TO keepem
CLEAR
RESTORE FROM keepem

USE b:sampfile

* Initialize counter
STORE 1 TO counter

* Set up loop to occur n times, where n = sampnum
DO WHILE counter <= sampnum

   * Increment counter.
   STORE counter + 1 TO counter

   * Calculate pseudorandom number
   STORE seed + 3.14159265 TO seed
   STORE seed * seed TO seed
   STORE seed - INT(seed) TO seed

   * Multiply pseudorandom number by the number of events to
   * obtain sample number, and store to random.
   STORE 1 + INT(noevents * seed) TO random

   * Ensure that random not larger than sampnum, nor smaller
   * than 1. If so, ignore random and decrement counter by 1.
   DO CASE

      CASE random > noevents .OR. random < 1
         STORE counter - 1 TO counter

      OTHERWISE

         * Ensure that the samples generated are unique. If not,
         * do not append the sample to the list, but decrement
         * the counter by 1.

         LOCATE ALL FOR random = eventno
         IF EOF
```

```
            CASE noevents >= 501 .AND. noevents <= 1200
            STORE 32 TO sampnum

            CASE noevents >= 1201 .AND. noevents <= 3200
            STORE 50 TO sampnum

            CASE noevents >= 3201 .AND. noevents <= 10000
            STORE 80 TO sampnum

            CASE noevents >= 10001 .AND. noevents <= 35000
            STORE 125 TO sampnum

            CASE noevents >= 35001 .AND. noevents <= 150000
            STORE 200 TO sampnum

            CASE noevents >= 150001 .AND. noevents <= 500000
            STORE 315 TO sampnum

            CASE noevents > 500001
            STORE 500 TO sampnum

            OTHERWISE
            ERASE
            @ 8,15 SAY "NUMBER OF EVENTS ENTERED IS OUT OF RANGE"
            @ 10,15 SAY "OF THIS PROGRAM. PLEASE CONTACT YOUR"
            @ 12,15 SAY "SUPERVISOR"
            @ 16,15 SAY "Press any key to continue"
            @ 17,1 SAY "                                                "
            @ 18,1 SAY "                                                "
            @ 19,1 SAY "                                                "
            @ 20,1 SAY "                                                "
            @ 21,1 SAY "                                                "
            @ 22,1 SAY "                                                "
            WAIT

        ENDCASE

ENDCASE

RETURN
```

```
        STORE 200 TO sampnum

        CASE noevents >= 10001 .AND. noevents <= 35000
        STORE 315 TO sampnum

        CASE noevents >= 35001 .AND. noevents <= 150000
        STORE 500 TO sampnum

        CASE noevents >= 150001 .AND. noevents <= 500000
        STORE 800 TO sampnum

        CASE noevents > 500001
        STORE 1250 TO sampnum

        OTHERWISE
        ERASE
        @ 8,15 SAY "NUMBER OF EVENTS ENTERED IS OUT OF RANGE"
        @ 10,15 SAY "OF THIS PROGRAM. PLEASE CONTACT YOUR"
        @ 12,15 SAY "SUPERVISOR"
        @ 16,15 SAY "Press any key to continue"
        @ 17,1 SAY "                                                "
        @ 18,1 SAY "                                                "
        @ 19,1 SAY "                                                "
        @ 20,1 SAY "                                                "
        @ 21,1 SAY "                                                "
        @ 22,1 SAY "                                                "
        WAIT

    ENDCASE

CASE insplvl = "3"
  DO CASE

        CASE noevents >= 2 .AND. noevents <= 25
        STORE 2 TO sampnum

        CASE noevents >= 26 .AND. noevents <= 50
        STORE 3 TO sampnum

        CASE noevents >= 51 .AND. noevents <= 90
        STORE 5 TO sampnum

        CASE noevents >= 91 .AND. noevents <= 150
        STORE 8 TO sampnum

        CASE noevents >= 151 .AND. noevents <= 280
        STORE 13 TO sampnum

        CASE noevents >= 281 .AND. noevents <= 500
        STORE 20 TO sampnum
```

```
* MODULE 2.1
* SAMPGEN.CMD  VERSION 1.1    9 MAY 84        HEM

* This is the Sample Number Generation Module

* CALLED BY SELECT.CMD

* Given the number of events for the day (noevents) and the
* inspection level desired, generate the number of samples to be
* taken.

SAVE TO keepem
CLEAR
RESTORE FROM keepem

DO CASE

   CASE insplvl = "1" .OR. insplvl = "2"
      DO CASE

         CASE noevents >= 2 .AND. noevents <= 8
         STORE 2 TO sampnum

         CASE noevents >= 9 .AND.  noevents <= 15
         STORE 3 TO sampnum

         CASE noevents >= 16 .AND. noevents <= 25
         STORE 5 TO sampnum

         CASE noevents >= 26 .AND. noevents <= 50
         STORE 8 TO sampnum

         CASE noevents >= 51 .AND. noevents <= 90
         STORE 13 TO sampnum

         CASE noevents >= 91 .AND. noevents <= 150
         STORE 20 TO sampnum

         CASE noevents >= 151 .AND. noevents <= 280
         STORE 32 TO sampnum

         CASE noevents >= 281 .AND. noevents <= 500
         STORE 50 TO sampnum

         CASE noevents >= 501 .AND. noevents <= 1200
         STORE 80 TO sampnum

         CASE noevents >= 1201 .AND. noevents <= 3200
         STORE 125 TO sampnum

         CASE noevents >= 3201 .AND. noevents <= 10000
```

```
@ 21, 0 SAY "+================================================="
@ 21,50 SAY "==============================+"
```

```
* MODULE 2.0.1
* SELECT.FMT        VERSION 1      10 MAR 84      HEM

@  0,34 SAY "Select Menu"
@  1, 0 SAY "+================================================"
@  1,50 SAY "==============================+"
@  2, 0 SAY "!"
@  2,79 SAY "!"
@  3, 0 SAY "!    Based on the results of inspection process co"
@  3,50 SAY "mpleted for"
@  3,62 SAY xprev
@  3,73 SAY ",     !"
@  4, 0 SAY "!    the Automated Quality Assurance Program recom"
@  4,50 SAY "mends that today's           !"
@  5, 0 SAY "!    inspection be conducted under the"
@  5,39 SAY rcmd4
@  5,55 SAY "inspection level        !"
@  6, 0 SAY "!    in accordance with MIL STD 105D."
@  6,79 SAY "!"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!"
@  8,79 SAY "!"
@  9, 0 SAY "!    ENTER THE NUMBER OF EVENTS FOR JULIAN DATE"
@  9,47 SAY date
@  9,60 SAY ":"
@  9,62 GET noevents
@  9,79 SAY "!"
@ 10, 0 SAY "!"
@ 10,79 SAY "!"
@ 11, 0 SAY "!    Select The Inspection Level to be used for th"
@ 11,50 SAY "is day's run.                !"
@ 12, 0 SAY "!"
@ 12,79 SAY "!"
@ 13, 0 SAY "!    1. Normal Inspection"
@ 13,79 SAY "!"
@ 14, 0 SAY "!"
@ 14,79 SAY "!"
@ 15, 0 SAY "!    2. Increased Inspection"
@ 15,79 SAY "!"
@ 16, 0 SAY "!"
@ 16,79 SAY "!"
@ 17, 0 SAY "!    3. Reduced Inspection"
@ 17,79 SAY "!"
@ 18, 0 SAY "!"
@ 18,79 SAY "!"
@ 19, 0 SAY "!    ENTER INSPECTION LEVEL"
@ 19,28 GET insplvl
@ 19,79 SAY "!"
@ 20, 0 SAY "!"
@ 20,79 SAY "!"
```

```
* Give the user something to read during calculation
ERASE
@ 8,10 SAY"GENERATING RANDOM SAMPLES AT THIS TIME"

*  Determine  the  number  of  samples  to  be  taken  given  the
* inspection level input and the number of events.
DO SAMPGEN

*  Generate n unique random samples,  where n = sampnum,  and the
*  range of the samples is from 1 to noevents.
DO RANDGEN

* Inform user that sample selection is complete, and give him
* instructions on how to return to Main Menu.
ERASE
@ 6,10 SAY"*******************************"
@ 7,10 SAY"*                             *"
@ 8,10 SAY"* SAMPLE GENERATION COMPLETE *"
@ 9,10 SAY"*                             *"
@ 10,10 SAY"*******************************"
DO delay2

USE b:daydata
LOCATE FOR julian = date

IF .NOT. EOF

   REPLACE samps WITH sampnum
   REPLACE events WITH noevents
   DO CASE
      CASE insplvl = "1"
         REPLACE finsplvl WITH rcmd1

      CASE insplvl = "2"
         REPLACE finsplvl WITH rcmd2

      CASE insplvl = "3"
         REPLACE finsplvl WITH rcmd3
   ENDCASE
ELSE
   DO selerr1
   DO delay2
ENDIF

RELEASE ALL LIKE rcmd*
RELEASE ALL LIKE x*

DO notify

RETURN
```

```
   SET FORMAT TO SCREEN
ENDDO
* Release all temporary memory variables
RELEASE ALL LIKE t:*
RETURN
```

```
* MODULE 3.1.1
* TIMERPT.CMD  VERSION 1      1 APR 84       HEM

SET FORMAT TO PRINT
SET MARGIN TO  10
@  2,31 SAY "TIMELINESS REPORT"
@  4, 0 SAY "IRR No:"
@  4, 8 SAY JULIAN
@  4,15 SAY TIME
@  4,21 SAY RECNO
@  4,28 SAY "T"
@  6, 0 SAY "A. Time that Gov't provided input:_____________"
@  8, 0 SAY "B. Time Event/Output was completed:_____________"
@ 10, 0 SAY "C. Throughput (B - A)_____________"
@ 12, 0 SAY "D. Standard:_____________"
@ 14, 0 SAY "E. Accept/Reject:_____________"
@ 16, 0 SAY "================================================="
@ 16,50 SAY "=========================="
@ 17, 0 SAY "Rejection caused by:"
@ 49,40 SAY "Contractor Caused (Y/N):_____________"
@ 51,40 SAY "Government Caused (Y/N):_____________"
@ 53,40 SAY "Database Updated? _____________"
@ 56,40 SAY "_____________________________________"
@ 57,40 SAY "NARDAC S.F."
@ 58,40 SAY "QAE Representative"
SET FORMAT TO SCREEN
RETURN
```

```
* MODULE 3.1.2
* QUALRPT.CMD  VERSION 1      1 APR 84       HEM

SET FORMAT TO PRINT
SET MARGIN TO  10
@  3,33 SAY "QUALITY REPORT"
@  5, 0 SAY "IRR No:"
@  5, 8 SAY JULIAN
@  5,15 SAY TIME
@  5,21 SAY RECNO
@  5,28 SAY "Q"
@  7, 0 SAY "Client Command:_____________________________________"
@  7,50 SAY "_________________"
@  9, 0 SAY "Is the Quality Acceptable? (Y/N)_____________"
@ 11, 0 SAY "Is it Accurate? (Y/N)_____________"
@ 13, 0 SAY "================================================="
@ 13,50 SAY "=========================="
@ 14, 0 SAY "Rejection caused by:"
@ 52,40 SAY "Database Updated? ___________"
@ 55, 0 SAY "_____________________________      __________"
@ 55,50 SAY "_____________________________"
@ 56, 0 SAY "Client Command                    NARDAC S.F"
@ 56,50 SAY "."
@ 57, 0 SAY "Representative                    QAE Repres"
@ 57,50 SAY "entative"
SET FORMAT TO SCREEN
RETURN
```

```
* MODULE 3.2
* INSPRES.CMD  VERSION 2.2    24 MAR 84      HEM

* This module use the julian date specified in SETJULN, and
* accepts the time and record number to determine which record is
* to be updated. It then allows the user to input inspection
* results to the specified record.

* CALLED BY: INPUT.CMD
* FORMAT FILE USED: INSPRES.FMT

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Prevent calculations from showing on screen
SET TALK OFF

* Allow both upper and lower case inputs
SET EXACT OFF

STORE "Inputting Inspection Results" TO mode
DO setjuln

* Specify file to be used
USE B:IRR

* Set up loop
STORE Y TO more

* Loop program
DO WHILE more

* Define format
SET FORMAT TO inspres

* Initialize variables
STORE 0 TO xtime
STORE 0 TO xrecno
STORE " " TO xtype
STORE Y TO xtstep

* Execute
READ

STORE !(xtype) TO xtype
* Locate the record whose results are to be input
LOCATE FOR julian = date .AND. time = xtime .AND. recno = xrecno

* Ensure the record exists. If not, loop back to INSPRES.FMT.
IF .NOT. EOF
```

```
   DO CASE
      * Input the results of timeliness inspections
      CASE !(xtype) = "T"
         * Set T report flag to yes.
         REPLACE T WITH xtstep
         ERASE
         @ 2,2 SAY "IRR No."
         @ 2,10 SAY date
         @ 2,20 SAY xtime
         @ 2,30 SAY xrecno
         @ 2,42 SAY xtype
         ?
         ?
         * Input site data
         ACCEPT "SITE?" TO xsite
         REPLACE site WITH !(xsite)

         * Input results of timeliness inspection.
         INPUT "DID THE SAMPLE PASS THE TIMELINESS ;
INSPECTION?" TO xtac
         REPLACE taccept WITH xtac
         IF xtac
            * If the inspection was successful, set the
            * time problem flag to no, and find out if there
            * are any more inspection results to input.
            STORE N TO xt
            REPLACE timeprob WITH xt
            INPUT "Any more inspection results to input now?";
                TO more
         ELSE
            * If the Inspection was not successful, set the
            * time problem flag to no, find out if the
            * problem was the result of system problems or
            * was the fault of the gov't. Find out if there
            * are any more inspection results to input.
            STORE N TO xt
            REPLACE timeprob WITH xt
            ERASE

            @ 2,2 SAY "IRR No."
            @ 2,10 SAY date
            @ 2,20 SAY xtime
            @ 2,30 SAY xrecno
            @ 2,42 SAY xtype
            ?
            ?
            INPUT " WAS THE DISCREPANCY THE RESULT OF SYSTEM ;
FAILURE?" TO xs
            REPLACE system WITH xs
            INPUT " WAS THE DISCREPANCY THE FAULT OF THE ;
```

```
GOVERNMENT?" TO xg
            REPLACE govt WITH xg
            INPUT " Any more inspection results to input?";
            TO more
         ENDIF

       * Input the results of quality inspections
      CASE !(xtype) = "Q"
         * Set the Q report flag to yes.
         REPLACE Q WITH xtstep
         ERASE
         * Input the results of quality inspections

         @ 2,2 SAY "IRR No."
         @ 2,10 SAY date
         @ 2,20 SAY xtime
         @ 2,30 SAY xrecno
         @ 2,42 SAY xtype
         ?
         ?

         INPUT "DID THE SAMPLE PASS THE QUALITY ;
INSPECTION?" TO xqac
         REPLACE qaccept WITH xqac

  * If the inspection was successful, set the
         * quality problem flag to no, and find out if
         * there are any more inspection results to input.
         IF xqac
            INPUT "Any more inspection results to input now?";
                TO more
         ELSE
            *If the inspection was not successful, set the
            * quality problem flag to yes, and find out if
            * the problem was one of accuracy or of quality.
            ERASE

            @ 2,2 SAY "IRR No."
            @ 2,10 SAY date
            @ 2,20 SAY xtime
            @ 2,30 SAY xrecno
            @ 2,42 SAY xtype
            ?
            ?

            INPUT "ACCURACY DISCREPANCY?" TO xa
            REPLACE accuprob WITH xa
            INPUT "QUALITY DISREPANCY?" TO xq
            REPLACE qualprob WITH xq
            INPUT "Any more inspection results to input now?";
            TO more
```

```
         ENDIF
      ENDCASE

      * Release temporary variables
      RELEASE ALL LIKE x*

   ENDIF
   ENDDO

* Release loop variable
RELEASE more

RETURN
```

```
* MODULE 3.2.1
* INSPRES.FMT  VERSION 1.2    24 MAR 84      HEM

@  0,28 SAY "Input Inspection Results"
@  1, 0 SAY "+================================================"
@  1,50 SAY "==============================+"
@  2, 0 SAY "!"
@  2,79 SAY "!"
@  3, 0 SAY "!    You are now ready to input the inspection res"
@  3,50 SAY "ults for                          !"
@  4, 0 SAY "!    Julian date"
@  4,16 SAY date
@  4,28 SAY ". During this process you will be asked several"
@  4,79 SAY "!"
@  5, 0 SAY "!    questions. When asked for the site of the ins"
@  5,50 SAY "pection, input the first     !"
@  6, 0 SAY "!    letter of the site (A = Alameda, L = Lemoore,"
@  6,51 SAY "M = Moffett, etc.), or      !"
@  7, 0 SAY "!    type of report (T = Timeliness, Q = Quality)."
@  7,51 SAY "For all the other           !"
@  8, 0 SAY "!    questions, reply with Y (Yes) or N (No)."
@  8,79 SAY "!"
@  9, 0 SAY "!"
@  9,79 SAY "!"
@ 10, 0 SAY "!    Time"
@ 10, 9 GET xtime
@ 10,20 SAY "Record No."
@ 10,30 GET xrecno
@ 10,41 SAY "Report Type (T or Q)"
@ 10,61 GET xtype
@ 10,79 SAY "!"
@ 11, 0 SAY "!"
@ 11,79 SAY "!"
@ 12, 0 SAY "+================================================"
@ 12,50 SAY "==============================+
```

```
* MODULE 4.0
* ANALYZE.CMD VERSION 1.2      12 APR 84     HEM

* This module takes the data input from INSPRES.CMD, compares it
* with information in DAYDATA, and in accordance with MIL STD -
* 105D accepts or rejects that day's work. The module then sets
* the recommended inspection level for the next day, and makes
* reports as needed to QA personnel.

* CALLED BY: MAIN.CMD
* FORMAT FILE USED: ANALYZE1.FMT

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Prevent calculations from showing on screen
SET TALK OFF

* Allow both upper and lower case inputs
SET EXACT OFF

* Initialize variables
STORE 0 TO date

* Give the user something to read
ERASE
SET FORMAT TO ANALYZE1
READ
*DO delay2

* Ensure that all samples for the day in question have been
* inspected, and that both T and Q reports are in for all
* samples.
DO SAMPCHEK

* Determine whether the day's work is accepted or rejeted.
DO SAMPANAL

* Prescribe the recommended inspection level for the next day's
* work.
DO INSPANAL

* Make required reports
DO INSPRPT

* Return to the Main Menu
RETURN
```

```
* MODULE 4.0.1
* ANALYZE1.FMT      VERSION 1.2    24 MAR 84      HEM

@  1,33 SAY "Sample Analysis"
@  2, 0 SAY "+================================================"
@  2,50 SAY "==============================+"
@  3, 0 SAY "!"
@  3,79 SAY "!"
@  4, 0 SAY "!    At this time, the program will analyze the da"
@  4,50 SAY "ta input previously.          !"
@  5, 0 SAY "!"
@  5,79 SAY "!"
@  6, 0 SAY "!    FOR WHICH JULIAN DATE IS ANALYSIS TO BE DONE?"
@  6,50 GET date
@  6,79 SAY "!"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!    You will be informed when analysis is complet"
@  8,50 SAY "e, and requested to          !"
@  9, 0 SAY "!"
@  9,79 SAY "!"
@ 10, 0 SAY "!    choose output options at that time."
@ 10,79 SAY "!"
@ 11, 0 SAY "!"
@ 11,79 SAY "!"
@ 12, 0 SAY "+================================================"
@ 12,50 SAY "==============================+"
```

```
* MODULE 4.1
* SAMPCHEK.CMD  VERSION 1.2     12 APR 84     HEM

* This module ensures that all samples for the day in question
* have been inspected, and that both T and Q reports are
* completed for all samples.

* CALLED BY: ANALYZE.CMD
* FORMAT FILE USED: SAMPCHEK.FMT

SAVE TO keepem
CLEAR
RESTORE FROM keepem

USE b:daydata

LOCATE FOR julian = date

SELECT SECONDARY
USE b:irr

COUNT FOR julian = date TO daycount

* Ensure all samples have been input for the day specified
IF daycount <> samps

   ERASE
   DO error1
   DO delay2
   DO input

ELSE
   * Ensure both reports in for all samples for the day specified
   LOCATE FOR julian = date .AND. .NOT. T .OR.;
   julian = date .AND. .NOT.  Q

    IF .NOT. EOF
       DO error2
       DO delay2
       DO input
    ENDIF

ENDIF

RELEASE daycount

* Return to the calling program
RETURN
```

```
* MODULE 4.1.1
* ERROR1.CMD   VERSION 1.0    12 APR 84      HEM

ERASE
@  3, 0 SAY "+================================================="
@  3,50 SAY "=============================+"
@  4, 0 SAY "!"
@  4,79 SAY "!"
@  5, 0 SAY "!                          ERROR!  ERROR!  ERROR!  ERROR"
@  5,50 SAY "!  ERROR!                          !"
@  6, 0 SAY "!"
@  6,79 SAY "!"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!    YOU HAVE NOT ENTERRED ALL THE RECORDS FOR DAT"
@  8,50 SAY "E"
@  8,52 SAY julian
@  8,79 SAY "!"
@  9, 0 SAY "!"
@  9,79 SAY "!"
@ 10, 0 SAY "!"
@ 10,79 SAY "!"
@ 11, 0 SAY "!"
@ 11,79 SAY "!"
@ 12, 0 SAY "!    YOU WILL BE RETURNED TO THE INPUT OPTION AT T"
@ 12,50 SAY "HIS TIME TO COMPLETE          !"
@ 13, 0 SAY "!"
@ 13,79 SAY "!"
@ 14, 0 SAY "!    INPUT ACTION FOR THIS DATE."
@ 14,79 SAY "!"
@ 15, 0 SAY "!"
@ 15,79 SAY "!"
@ 16, 0 SAY "!"
@ 16,79 SAY "!"
@ 17, 0 SAY "+================================================="
@ 17,50 SAY "=============================+"
RETURN
```

```
* MODULE 4.1.2
* ERROR2.CMD   VERSION 1.0    12 APR 84      HEM

ERASE
@  4, 0 SAY "+================================================="
@  4,50 SAY "=============================+"
@  5, 0 SAY "!"
@  5,79 SAY "!"
@  6, 0 SAY "!                        ERROR!  ERROR!  ERROR!  ERROR"
@  6,50 SAY "!  ERROR!                       !"
@  7, 0 SAY "!"
@  7,79 SAY "!"
@  8, 0 SAY "!"
@  8,79 SAY "!"
@  9, 0 SAY "!    ON AT LEAST ONE SAMPLE FOR JULIAN DATE"
@  9,44 SAY julian
@  9,57 SAY "YOU FAILED TO         !"
@ 10, 0 SAY "!"
@ 10,79 SAY "!"
@ 11, 0 SAY "!    INPUT BOTH THE T AND Q INSPECTION REPORTS. YO"
@ 11,50 SAY "U WILL BE RETURNED TO        !"
@ 12, 0 SAY "!"
@ 12,79 SAY "!"
@ 13, 0 SAY "!    THE INPUT OPTION AT THIS TIME TO INPUT THE RE"
@ 13,50 SAY "QUIRED REPORTS.              !"
@ 14, 0 SAY "!"
@ 14,79 SAY "!"
@ 15, 0 SAY "+================================================="
@ 15,50 SAY "=============================+"
RETURN
```

```
MODULE 4.2
SAMPANAL.CMD    VERSION 1.1    9 MAY 84       HEM

This module analyzes the inspection results input in the input
section, and determines first, whether the day's results passed
the inspection, and second, (in the case of the reduced
inspection level) what level of inspection should be used for
the next day.

NOTE! AS PRESENTED, THIS MODULE REFLECTS MIL-STD-105D FOR AN
AQL OF 2.5. SHOULD THIS AQL BE CHANGED, IT IS MANDATORY THAT
THIS MODULE BE CHANGED TO REFLECT THAT CHANGE IN AQL!

\VE TO keepem
LEAR
ESTORE FROM KEEPEM

 CALLED BY: ANALYZE.CMD

TORE N TO taccept

3E b:irr

 Determine the total number of bad samples
)UNT FOR julian = date .AND. .NOT. qaccept .AND. NOT. govt .OR.;
ulian = date .AND. .NOT. taccept .AND. .NOT. govt TO rejectno

3E b:daydata
)CATE FOR julian = date

 Determine whether to accept or reject the day's work
) CASE

   CASE finsplvl = "Normal"
     DO CASE

        CASE samps = 2 .OR. samps = 3 .CR. samps = 5 .OR.;
        samps = 8
           IF rejectno = 0
              STORE Y TO taccept
           ENDIF

        CASE samps = 13 .OR. samps = 20
           IF rejectno <= 1
              STORE Y TO taccept
           ENDIF

        CASE samps = 32
           IF rejectno <= 2
              STORE Y TO taccept
           ENDIF
```

```
            CASE samps = 50
               IF rejectno <= 3
                  STORE Y TO taccept
               ENDIF

            CASE samps = 80
               IF rejectno <= 5
                  STORE Y TO taccept
               ENDIF

            CASE samps = 125
               IF rejectno <= 7
                  STORE Y TO taccept
               ENDIF

            CASE samps = 200
               IF rejectno <= 10
                  STORE Y TO taccept
               ENDIF

            CASE samps = 315
               IF rejectno <= 14
                  STORE Y TO taccept
               ENDIF

            CASE samps >= 500
               IF rejectno <= 21
                  STORE Y TO taccept
               ENDIF

            ENDCASE

      * Determine whether to accept or reject the day's work
         CASE finsplvl = "Tightened"
            DO CASE

            CASE samps = 2 .OR. samps = 3 .OR. samps = 5 .OR.;
            samps = 8
               IF rejectno = 0
                  STORE Y TO taccept
               ENDIF

            CASE samps = 13 .OR. samps = 20 .OR. samps = 32
               IF rejectno <= 1
                  STORE Y TO taccept
               ENDIF

            CASE samps = 50
               IF rejectno <= 2
                  STORE Y TO taccept
```

```
            ENDIF

         CASE samps = 80
            IF rejectno <= 3
               STORE Y TO taccept
            ENDIF

         CASE samps = 125
            IF rejectno <= 5
               STORE Y TO taccept
            ENDIF

         CASE samps = 200
            IF rejectno <= 8
               STORE Y TO taccept
            ENDIF

         CASE samps = 315
            IF rejectno <= 12
               STORE Y TO taccept
            ENDIF

         CASE samps >= 500
            IF rejectno <= 18
               STORE Y TO taccept
            ENDIF

      ENDCASE

* Determine whether to accept or reject the day's work
* Determine the recommended inspection level for the next day

   CASE finsplvl = "Reduced"
      DO CASE

         CASE samps = 2 .OR. samps = 3
            IF rejectno = 0
               STORE Y TO taccept
               REPLACE rcmdinsp WITH "Reduced"
            ELSE
               REPLACE rcmdinsp WITH "Normal"
            ENDIF

         CASE samps = 5 .OR. samps = 8
            DO CASE
               CASE rejectno = 0
                  STORE Y TO taccept
                  REPLACE rcmdinsp WITH "Reduced"

               CASE rejectno = 1
                  STORE Y TO taccept
```

```
            REPLACE rcmdinsp WITH "Normal"

         CASE rejectno >= 2
            STORE N TO taccept
            REPLACE rcmdinsp WITH "Normal"

      ENDCASE

   CASE samps = 13
      DO CASE
         CASE rejectno <= 1
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Reduced"

         CASE rejectno = 2
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Normal"

         CASE rejectno >= 3
            STORE N TO taccept
            REPLACE rcmdinsp WITH "Normal"

      ENDCASE


   CASE samps = 20
      DO CASE
         CASE rejectno <= 1
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Reduced"

         CASE rejectno > 1 .AND. rejectno <= 3
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Normal"

         CASE rejectno >= 4
            STORE N TO taccept
            REPLACE rcmdinsp WITH "Normal"

      ENDCASE

   CASE samps = 32
      DO CASE
         CASE rejectno <= 2
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Reduced"

         CASE rejectno > 2 .AND. rejectno <= 4
            STORE Y TO taccept
            REPLACE rcmdinsp WITH "Normal"
```

```
      CASE rejectno >= 5
         STORE N TO taccept
         REPLACE rcmdinsp WITH "Normal"

   ENDCASE

CASE samps = 50
   DO CASE
      CASE rejectno <= 3
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Reduced"

      CASE rejectno > 3 .AND. rejectno <= 5
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Normal"

      CASE rejectno >= 6
         STORE N TO taccept
         REPLACE rcmdinsp WITH "Normal"

   ENDCASE

CASE samps = 80
   DO CASE
      CASE rejectno <= 5
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Reduced"

      CASE rejectno > 5 .AND. rejectno <= 7
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Normal"

      CASE rejectno >= 8
         STORE N TO taccept
         REPLACE rcmdinsp WITH "Normal"

   ENDCASE

CASE samps = 125
   DO CASE
      CASE rejectno <= 7
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Reduced"

      CASE rejectno > 7 .AND. rejectno <= 9
         STORE Y TO taccept
         REPLACE rcmdinsp WITH "Normal"

      CASE rejectno >= 10
         STORE N TO taccept
         REPLACE rcmdinsp WITH "Normal"
```

```
            ENDCASE

         CASE samps >= 200
            DO CASE
               CASE rejectno <= 10
                  STORE Y TO taccept
                  REPLACE rcmdinsp WITH "Reduced"

               CASE rejectno > 10 .AND. rejectno <= 12
                  STORE Y TO taccept
                  REPLACE rcmdinsp WITH "Normal"

               CASE rejectno >= 13
                  STORE N TO taccept
                  REPLACE rcmdinsp WITH "Normal"

            ENDCASE

      ENDCASE

ENDCASE

IF taccept
   REPLACE accept WITH Y
ENDIF

* Perform Deduct Analysis
STORE samps TO sampnum
STORE 1000 * (rejectno / sampnum) TO fails
STORE  fails * .01 TO fails
REPLACE failrate WITH fails

* Return to calling program
RETURN
```

```
* MODULE 4.3
* INSPANAL.CMD    VERSION 1.1      9 MAY 84      HEM

* This module takes the results of SAMPANAL for the current
* day, as well as several other preceding days, to determine
* which level of inspection to recommend for the next day.

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* CALLED BY: ANALYZE.CMD

STORE 0 TO nobadays

USE b:daydata
INDEX ON julian TO daydex

LOCATE FOR julian = date

* Determine the recommended inspection level for the next day
DO CASE
   CASE finsplvl = "Normal"
      SKIP -4
      COUNT NEXT 5 FOR .NOT. accept TO nobadays
      IF nobadays >= 2
         LOCATE FOR julian = date
         REPLACE rcmdinsp WITH "Tightened"
      ELSE
         LOCATE FOR julian = date
         SKIP -9
         COUNT NEXT 10 FOR .NOT. accept TO nobadays
         IF nobadays = 0
            REPLACE rcmdinsp WITH "Reduced"
         ELSE
            REPLACE rcmdinsp WITH "Normal"
         ENDIF
      ENDIF


   CASE finsplvl = "Tightened"
      LOCATE FOR julian = date
      SKIP -4
      COUNT NEXT 5 FOR .NOT. accept TO nobadays
      IF nobadays = 0
         REPLACE rcmdinsp WITH "Normal"
      ELSE
         LOCATE FOR julian = date
         SKIP -9
         COUNT NEXT 10 FOR .NOT. accept to nobadays
         IF nobadays >= 10
```

```
            REPLACE rcmdinsp WITH "Terminate"
         ELSE
            REPLACE rcmdinsp WITH "Tightened"

         ENDIF
      ENDIF

   ENDCASE
RELEASE nobadays

SAVE TO keepem
CLEAR
RESTORE FROM keepem

* Return to the calling program
RETURN
```

```
* MODULE 4.4
* INSPRPT.CMD   VERSION 1.0     12 APR 84      HEM

* This module takes the inspection results generated
* previously, and prepares the Quality Assurance Reports.

SAVE TO keepem
CLEAR
RESTORE FROM keepem

USE b:daydata

LOCATE FOR julian = date

STORE finsplvl TO insplvl
STORE samps TO sampnum
STORE events TO eventno
STORE rcmdinsp TO rcmd

IF accept
   STORE " accepted." to tres
ELSE
   STORE " rejected." to tres
ENDIF

* Determine the type of output format to use. If terminate,
* output the termination report, otherwise output the
* status report.

IF rcmdinsp = "Terminate"
   SET FORMAT TO termrpt
   READ
ELSE
   SET FORMAT TO statrpt
   READ
   SET TALK OFF
   WAIT
   SET TALK ON
ENDIF


* Return to the calling program
RETURN
```

```
* MODULE 4.4.1
* STATRPT.FMT  VERSION 2.0          12 APR 84       HEM

@  4, 5 SAY "STATUS REPORT FOR JULIAN DATE"
@  4,35 SAY date
@  6, 5 SAY "As of"
@  6,11 SAY date
@  6,21 SAY ", the status of the contractor´s performance"
@  7, 5 SAY "is as follows:"
@  9, 5 SAY "Inspection of samples on"
@  9,30 SAY date
@  9,42 SAY "was conducted under the"
@ 10, 5 SAY insplvl
@ 10,16 SAY "Inspection Level, and the contractor´s work for th"
@ 10,66 SAY "at day"
@ 11, 5 SAY "was"
@ 11, 9 SAY tres
@ 13, 5 SAY "Number of jobs processed by contractor on"
@ 13,47 SAY date
@ 13,57 SAY ":"
@ 13,59 SAY eventno
@ 15, 5 SAY "Number of samples taken by QA personnel:"
@ 15,45 SAY sampnum
@ 17, 5 SAY "Number of samples which failed inspection:"
@ 17,48 SAY rejectno
@ 19, 5 SAY "As a result of the above findings, and in accordan"
@ 19,55 SAY "ce with"
@ 20, 5 SAY "Mil Std-105D, it is recommended that the contract"
@ 20,55 SAY "be continued,"
@ 21, 5 SAY "and that the contractor´s work for the next day be"
@ 21,56 SAY "inspected under"
@ 22, 5 SAY "the"
@ 22, 9 SAY rcmd
@ 22,20 SAY "level of inspection."
```

```
* MODULE 4.4.2
* TERMRPT.FMT  VERSION 1.0    12 APR 84      HEM

@  3,22 SAY "ATTENTION!   ATTENTION!   ATTENTION!"
@  5, 5 SAY "As a result of the contractor having been placed o"
@  5,55 SAY "n Tightened"
@  6, 5 SAY "Inspection for the previous ten days, and as the c"
@  6,55 SAY "ontractor´s"
@  7, 5 SAY "work has failed inspection for all of those ten da"
@  7,55 SAY "ys; in"
@  8, 5 SAY "accordance with the procedures set forth in Mil St"
@  8,55 SAY "d-105D it"
@  9, 5 SAY "is recommended that the inspection process now be"
@  9,55 SAY "suspended,"
@ 10, 5 SAY "and that the contractor be placed in default of co"
@ 10,55 SAY "ntract."
```

```
* MODULE 5.0
* UTILITY.CMD        VERSION 1.0     2 MAY 84        HEM
* This is the menu module for all utility programs.

ERASE
@ 10,10 SAY "THIS IS THE UTILITY MENU PROGRAM STUB"
@ 14,10 SAY "Press any key to continue."



WAIT
RETURN
```

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